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THE FIRST RADIOCARBON DATA FROM THE SETTLEMENT NITRA-LUPKA

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ABSTRACT. Nitra-Lupka is an important site from the Great Moravian period in Slovakia. A fortified hillfort which was supposed to be from this period, a battery of pottery kilns, and an Early Medieval cemetery were found on the site and researched during 1959–1975. Further, a few small-range excavations took place on the site at the beginning of the 21st century. At the same time, the dating of the hillfort to the Early Medieval period has begun to be questioned. There was also a problem with the localization of settlement that would belong to the battery of pottery kilns. The settlement was discovered recently in 2021 during development-led excavations at Nitra-Šindolka. It was found at the place of the construction of the ecoduct. Two ovens and four other features with numerous ceramics and other findings were discovered. Some of the bones (phalanges of cattle and goat/sheep) were dated by radiocarbon dating being the first ^{14}C data obtained from this site and therefore of high importance for its precise dating.

KEYWORDS: animal bones, Early Middle Ages, Great Moravia, Nitra-Lupka, settlement, western Slovakia.

INTRODUCTION

In northern and central Europe, outside the borders of the Frankish empire, in the early Middle Ages processes took place that led to the formation of the first states (Macháček 2012: 782–783). One such proto-state was Great Moravia, which was located in the territory of the present-day southeastern Czech Republic and western Slovakia. There are only a few written sources for this proto-state unit, and archaeological discoveries have played an important role in its research. The center of this unit was located in the Moravian area, concentrated around the sites of Mikulčice, Pohansko, and Staré Město. The site Nitra and its surrounding settlements had a specific position within the formation; it was the center of the Nitra principality before, as mentioned in a few historical sources. However, it is not known if Nitra was the only such center in Slovakia or if more of them existed (Bednár and Ruttkay 2014:243). The form of the Nitra settlement agglomeration is also debated (in summary Fusek 2008). It is the archaeological finds that can shed light on this debate. One of the settlements that formed an economic hinterland of Nitra and a manufacturing center with its production of pottery with links to the Nitra principality is Lupka, which has attracted attention since its discovery.

SITE DESCRIPTION

Lupka is the name of the outcrop running out of the southwestern part of Zobor. It is situated above river Nitra's wide left bank floodplain and its left bank afflux Dobrotka. It is 107 m higher than the surrounding country. The upper part of the outcrop is forested. On slopes under the crown of the hill is still a visible rampart with a height of up to 1 m which demarcates territory with a size of about 3.6 ha (Ruttkay 2015:312). Several types of archaeological sites from the Early Middle Ages were found there (Figure 1).

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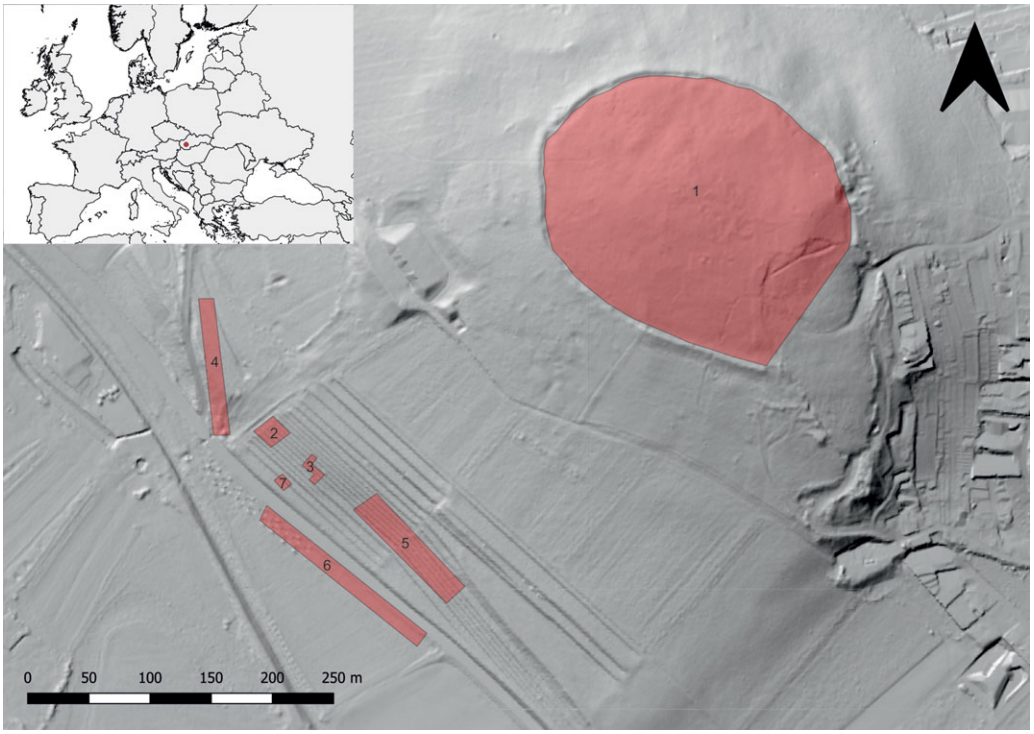

Figure 1 The position of Lupka within Slovakia and the plan of sites and their mutual position 1—hillfort; 2—battery of pottery kilns (1–4, 10); 3—battery of pottery kilns (5–9, 12); 4—an approximate area where another kiln was found; 5—cemetery; 6—an approximate area where the feature in 2007 could have been found; 7—an area where settlement features were found in 2021 (datasource: © EuroGeographics for the administrative boundaries; datasource of products LLS: ÚGKK SR).

Hillfort

The hillfort was discovered first by Š. Janšák in 1928 (Janšák 1929:8–9), because of its most striking appearance. At that time, the outcrop was densely forested in its northwestern half and covered in sparser deciduous forest supplemented with bushes and conifers in the southeastern part. He assumed that the hillfort was from the period of Hallstatt culture, although he described the archaeological findings as more precisely indeterminable. The hillfort started to be considered Early Medieval in the 1960s when the pottery kilns and cemetery were discovered during the establishment of the vineyard at the southern slope of Lupka. Their discovery had evoked the research on hillfort which started in 1960. 16 trenches on the acropolis and the rampart were dug, which were supposed to obtain information about the settlement of the hillfort (Vendtová 1962). The excavations proved the existence of the prehistorical settlement. Several smaller features and one house were uncovered. The bland ceramic material was dated only roughly to the urnfield culture period (Veliačik and Romsauer 1994:121). The Early Medieval findings were not registered.

B. Chropovský mentions also the existence of a fortified bailey at the south and southwestern slope of Lupka, protected by the rampart and inner ditch (Chropovský 1959:820, 1979). During the research, the rampart was identified only in the forest in the southwestern part of the slope in evident terrain disruption (Chropovský 1961:fig. 2). According to a written source,

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Figure 2 Features from which samples were taken and their approximate position after their discovery on site. Feature 4 after the removal of half of its filling with the visible black layer from which the sample was taken, and features 6 and 7 after the complete removal of their filling. 1—approximate position of features on the level of their discovery, 2—feature 6, 3—feature 4, 4—feature 7.

it was 2–3 m high and the ditch was 1.5 m deep. In the place of a vineyard, the rampart was identified only in the form of a dark line of soil and spread stones. The author of the research mentioned the existence of houses with stone socles (Chropovský 1975:7). However, it is not known where and when these features were uncovered. Certainly, the bailey was not excavated as early as 1961 (Chropovský 1961:142). The information about settlement features in the bailey occurs for the first time in 1975 (Chropovský 1975:7). There is no available terrain documentation for this research and no other information was published.

Although the known findings have not proved the presence of Early Medieval settlement, the hillfort was considered to be Great Moravian until the end of the 20th century. After the critical evaluation of sources, the function of the hillfort in this period was reconsidered. It might have not been settled but it may have been used occasionally in the case of need as a refugium. The bailey is more problematic. There are no visible remains of its fortification, although the hillfort

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was scanned from the plane (Ruttkay 2015:fig. 26). Currently there is no proof of the existence of the bailey.

Pottery Kilns

The pottery kilns were discovered together with the cemetery outside the fortified area. The sherd concentrations and burnt clay have been discovered since 1959 (Fottová 2019:76). They were accumulated in one place, a few meters above the road between Nitra and Dražovce and seven meters to the south of the line of forest. After this discovery, systematic research was carried out by B. Chropovský (Chropovský 1959, 1979). The torsos of 11 pottery kilns concentrated in two batteries, one pottery kiln on the edge of a cemetery, and five graves were found.

Another pottery kiln was discovered on the southern slope of Lupka in 1974 (Császta 1975:42, fig. 19). It was found during the building of a road towards the water reservoir. Also found was a layer with archaeological finds. The kiln with a one-part chamber and a firm, red-burnt bottom was sunken into the slope. The clay dome had an inner height of up to 90 cm. The charcoals, ash, and three fragments of ceramic decorated with horizontal grooves burnt to a red color were found inside. The material is comparable with the findings of ceramics from nearby kilns. This kiln could have been found 25–100 m towards the west or northwest of previously found pottery kilns.

Cemetery

The cemetery was found approximately 100 meters to the southeast of the concentration of kilns (Chropovský 1962). 91 graves dated to the 9th and 10th centuries were discovered. One of the skeletons was discovered under the pottery kiln in battery 2. The individual was laid with bend arms and legs in a non-reverent position outside the cemetery which is certainly not standard treatment of the body in this period (Chropovský 1962:177).

Settlement

The settlement, belonging to the inhabitants who produced pottery and were buried at the discovered cemetery, was unknown for a long time. The possible place of its existence suggested the feature found during an excavation of the trench for the water pipeline. The ceramic material was similar to the one from the pottery kilns. This finding was not localized into exact coordinates (Kopčeková et al. 2007:107–108), but according to archaeologists, it was close to the battery of kilns and graveyard. It was confirmed by the new excavation that took place after finding new features during the building of the ecoduct in 2021. The ecoduct was part of a larger project when the new road intersection was built at the site Šindolka. This construction also affected part of the road from Nitra to Dražovce which led under the hillfort and was a few meters from where a battery of pottery kilns and a cemetery were found. Also, the above-mentioned feature found during the digging of the waterpipe trench was found somewhere in this area under the road.

SETTLEMENT FEATURES

During the most recent excavation, seven settlement features were discovered allowing us to localize settlement connected with previous findings. Because it was impossible to confirm the bailey's dwellings, they are the first traces of existing Early Medieval settlement. The

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description of the features is based on the report that was produced during the research. The research documentation is currently being processed and will be stored in the Institute of Archaeology of the Slovak Academy of Sciences documentation.

Three ovens (features 1, 2, 3A) and five other features with unclear functions were found. In the ovens, only a few sherds were present. In the other features (3,4,6,7)[1] was found a large number of sherds from ceramic vessels, animal bones, spindle whorl, and stone and metal artifacts. The finding of the iron key in feature 4 is the most prominent of the metal finds. The ceramic findings were preliminarily dated to the 9th century and they are currently undergoing analysis. The results will be published in a separate article. The animal bones, which were found in these features offered an opportunity to date the site precisely. The phalanges of cattle and sheep/goat were considered to be the most suitable for radiocarbon (^{14}C) dating because they were well preserved. They were found in features 4, 6, and 7.

Feature 4 (Figure 2:1) was quite large, of an irregular shape, with several layers identified. The phalanx of sheep/goat was taken from the black layer found above the bottom of the feature. Most of the findings were found in this layer which seemed intact and was probably the oldest fill of it. There was an assumption that this layer was created shortly after the feature stopped being used. The function of the feature is unclear, but there is a possibility that it was outbuilding.

Feature 6 (Figure 2:2) was pear-shaped and quite deep. It could have been used for crop storage. It was clearly distinguished from the others and had no disturbances. It was filled with dark-brown clay mixed with the yellow-brown surrounding subsoil. No layers were distinguished in the feature, so it was probably filled at once. Four cattle phalanges (*Bos primigenius*) were found in the southwestern quarter of the feature.

Feature 7 (Figure 2:3) was found next to feature six. It was also probably used for crop storage since it was pear-shaped and deep. It was clearly distinguished from the surroundings and was not disturbed. The filling was brown clay. No layers were distinguished there too. One phalanx of cattle (*Bos primigenius*) was found there.

METHODS AND DESCRIPTIVE BACKGROUND

The samples were sent to two laboratories. Bones from features 4 and 7 and two phalanges from feature 6 were sent to the Poznań radiocarbon laboratory (Poz). Another two phalanges were dated in Prague in the Czech Radiocarbon Laboratory (CRL) at the Nuclear Physics Institute of CAS.

In the CRL, the samples were checked and mechanically cleaned. The cleaned samples were crushed and the fraction with grain diameters of 0.5–1 mm was leached in solutions of 0.5 M HCl, 0.1 M NaOH, and 0.01 M HCl, washing with distilled water between each step (Gupta and Polach 1985; Jull et al. 2006). The isolated collagen was gelatinized at 90ºC, filtered, and processed by ultrafiltration. A fraction of >30 kDa was dried to constant weight at 60ºC.

All samples were then sealed under a dynamic vacuum in quartz glass vials with the addition of CuO and combusted at 900ºC. The prepared carbon dioxide was purified and dosed into a

[1]Number 5 was originally a dark patch appearing in the northeastern part of the studied area, which seemed to be a feature, but after examination it was found to be a continuation of the topsoil humus layer which had accumulated in the lower parts of the slope.

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Table 1 ^{14}C date ranges of animal bones from features 4, 6, and 7.

No.	Lab code	Feature	Type of bone	^{14}C age (year BP)	Calibrated range (years AD)
1	CRL22 -0833	6	Cattle phalanx 1	1218 ± 14	772 (95.4%) 881
2	CRL22 -0834	6	Cattle phalanx 2	1207 ± 14	783 (95.4%) 880
3	Poz-150675	6	Cattle phalanx 1	1250 ± 30	674 (61.3%) 779 785 (26.0%) 837 846 (8.1%) 877
4	Poz-150676	6	Cattle phalanx 2	1170 ± 30	772 (73.9%) 901 916 (21.6%) 974
5	Poz-150677	7	Cattle phalanx 1	1515 ± 30	436 (4.7%) 464 476 (5.4%) 500 510 (0.5%) 515 531 (81.0%) 610 618 (3.9%) 640
6	Poz-150678	4	Sheep/goat phalanx	1280 ± 30	662 (90.8%) 777 791 (4.7%) 821

graphitization reactor. The graphitization method was derived from similar procedures used abroad (Molnár et al. 2013; Rinyu et al. 2013, 2015; Orsovszki and Rinyu 2015).

The measurements were performed on a MILEA accelerator mass spectrometer (Kučera et el. 2022). The samples were measured together with NIST oxalic acid (NBS) HOX II SRM 4990-C (Schneider et al 1995) and fossil phthalic anhydride. The measured ^{14}C activities and their combined uncertainties were expressed in years BP as conventional radiocarbon age (CRA) according to the Stuiver-Polach convention (Stuiver and Polach 1977). The calibration was performed using Oxcal 4.4 (Bronk-Ramsey 2009) and IntCal20 calibration curve (Reimer et al. 2020). The results are presented in Table 1.

RESULTS AND DISCUSSION

There was an assumption that samples will be dated into the Early Middle Ages, more precisely into the 9th to 10th century, which was confirmed. Two bones from feature 6 were calibrated to 772–881 AD and to 783–880 AD within a 95.4% probability interval (see Figure 3). Therefore, the results of dating fit almost exactly into this 9th century. Because of the plateau on the calibration curve, which covers almost the entire 9th century (Macháček et al. 2016:167), we will probably not be able to narrow the dating interval.

Two other samples from feature 6 evaluated in the Poznań laboratory were dated to a wider time interval between 674–877 AD, and the other between 772–974 AD. The dating of these samples covers the end of the 8th and the whole 9th century, and for one sample extends into the 10th century, and for the other to the late 7th to the 8th century. These dating results, therefore, fit the default assumption only partially.

The sheep/goat phalanx from feature 4 has been dated between 662–777 or 791–821 AD. Thus, also dating to the 8th century is more likely, which is earlier than we have assumed. The phalanx from feature 7 was much older, dated between 436–640 AD, which is too early given the nature of the settlement and the finds.

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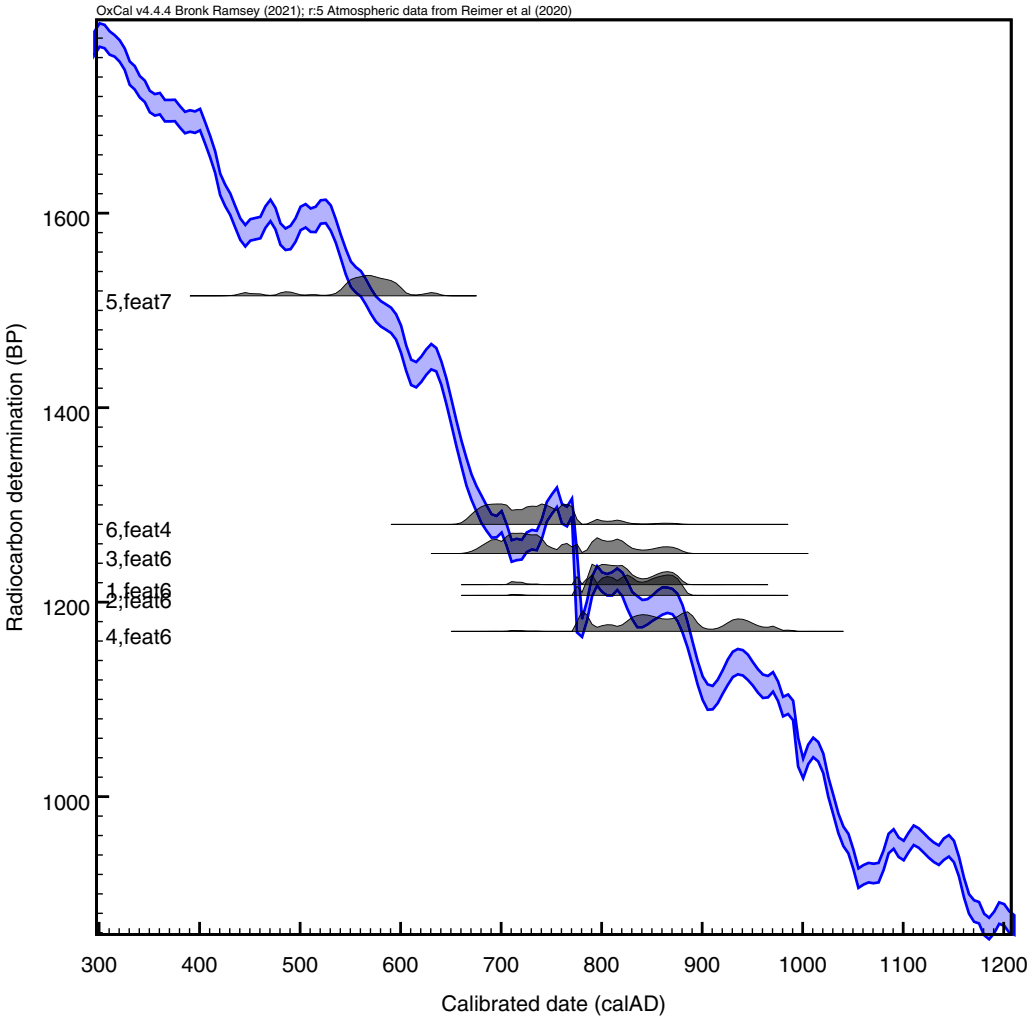

Figure 3 Calibrated dates of samples plotted on the IntCal20 calibration curve.

The earlier dating of the two samples from features 6 and 7 might suggest the existence of a settlement as early as the 8th century, even though the finds from the burial site do not imply this. Only a small part of the settlement was excavated, and it is possible that it was of a longer duration than assumed. In the period under study, there is also a change in burial rites at the turn of the 8th and 9th centuries, when cremation burials are replaced by inhumation ones. It is possible, therefore, that earlier excavations failed to capture earlier cremation graves, or that they may have been located outside the area than under investigation. The features were probably backfilled with clay and material from settlement layers, so the residues from different phases of occupation may have entered the features. In this way, a very early-dated bone could have entered feature 7, coming either from an even earlier context or as an accidental presence of such an animal on the site. Given that this is the only sample of such old age, careful comparison of the material and possible supplementary ^{14}C analysis should be required to provide further information about the feature. This is the subject of ongoing research.

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The area where the settlement features were discovered is quite small (the uncovered area has dimensions of less than 10 × 10 m) and some of the findings could have been destroyed by building processes. It was not possible to uncover the surroundings of the site. The use of non-invasive methods such as geophysical survey could provide further information about the settlement structure of this area. The next step is the analysis of findings from features and dating of this material. By comparison of ceramics, ^{14}C dating, and the material from previous excavations in this location we may be able to gain a clearer image of the site and its past inhabitants.

CONCLUSION

We could confirm the Lupka site's dating to the Early Medieval Period. It seems that the settlement could have lasted at least until the end of the 9th century and that it was concurrent with the battery of pottery kilns and cemetery found. However other questions emerged with the evaluated data. We do not know the beginning and the extent of the settlement. There is also the task to find out whether it continued after the fall of Great Moravia (as the dating of the cemetery in the proximity suggests). All these problems can be solved only by future research and eventually by revision of questionable results of older excavations.

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REFERENCES

Bednár P, Ruttkay M. 2014. Nitra. In: Kouřil P, editor. Velká Morava a počátky křesťanství. Brno: The Institute of Archaeology of the Academy of Sciences of the Czech Republic. p. 243–248.

Bronk Ramsey C. 2009. Bayesian analysis of radiocarbon dates. Radiocarbon 51(1):337–360. doi: https://doi.org/10.1017/S0033822200033865

Császta J. 1975. Ďalšia slovanská pec z hradiska Lupka v Nitre. Archeologické výskumy a nálezy na Slovensku v roku 1974:42.

Fottová E. 2019. Typologicko-chronologický vývoj keramiky 8.-12. storočia v oblasti Nitry [dissertation]. Nitra: Filozofická fakulta Univerzity Komenského-Archeologický ústav Slovenskej akadémie vied.

Fusek G. 2008. Die Nebenareale in der Struktur des großmährischen Burgstadt von Nitra. In: Boháčová I, Poláček L, Hrsg, editors. Burg – Vorburg – Suburbium. Zur problematik der Nebenareale frühmittelalterlicher Zentren. Internationale Tagungen in Mikulčice VII. Brno: The Institute of Archaeology of the Academy of Sciences of the Czech Republic. p. 271–290.

Gupta SK, Polach HA. 1985. Radiocarbon dating practises at ANU. Canberra: ANU.

Chropovský B. 1959. Slovanské hrnčiarske pece v Nitre. Archeologické rozhledy 11:818–825, 812–816, 849, 850.

Chropovský B. 1961. K otázkam historického postavenia Nitry v VIII. a IX. storočí. Študijné Zvesti Archeologického ústavu Slovenskej akadémie vied 6:139–160.

Chropovský B. 1962. Slovanské pohrebisko v Nitre na Lupke. Slovenská Archeológia X(1):175–240.

Chropovský B.1975. Nitra. In: Archeologický výskum slovanských lokalít. III. Medzinárodný kongres slovanskej archeológie. Bratislava 7.-14. september 1975. Nitra: Archeologický ústav Slovenskej akadémie vied.

Chropovský B. 1979. Nálezová správa z výskumu slovanských hrnčiarskych pecí v Nitre Lupke. Výskumná dokumentácia 8749/79. Nitra: Archeologický ústav Slovenskej akadémie vied.

Janšák Š. 1929. Slovenské hradiská z doby halštatskej. Sborník MSS 23:1–33.

Jull AJT, Burr GS, Beck JW, Hodgins GWL, Biddulph DL, Gann J, Hatheway AL, Lange TE, Lifton NA. 2006. Application of accelerator mass spectrometry to environmental and paleoclimate studies at the University of Arizona. Radioactivity in the Environment 8:

https://doi.org/10.1017/RDC.2023.59 Published online by Cambridge University Press

3–23. doi: https://doi.org/10.1016/S1569-4860(05)08001-0

Kopčeková M; Bielich M, Čurný M. 2007. Stredoveké nálezy z Nitry. Archeologické výskumy a nálezy na Slovensku v roku 2005:107–108.

Kučera J, Maxeiner S, Muller A, Němec M, John J, Světlík I, Kameník J, Dreslerová D, Pachnerová Brabcová K, Tecl J, Bourquin J, Herrmann A, Fahrni S. 2022. A new AMS facility MILEA at the Nuclear Physics Institute in Řež, Czech Republic. Nuclear Instruments and Methods in Physics Research B 527:29–33.

Macháček J. 2012. "Velkomoravský stat"—kontroverze středoevropské medievistiky. Archeologické rozhledy LXIV:775–787.

Macháček J, Dresler P, Přichstalová R, Sládek V. 2016. Břeclav—Pohansko VII. Kostelní pohřebiště na Severovýchodním předhradí. Brno: Filozofická fakulta, Masarykova univerzita.

Molnár M, Janovics R, Major I, Orsovszki J, Gönczi R, Veres M, Leonard AG, Castle SM, Langy TE, Wacker L, Hajdas I, Jull AJT. 2013. Status report of the new AMS ^{14}C sample preparation lab of the Hertelendi Laboratory of Environmental Studies (Debrecen, Hungary). Radiocarbon 55(2–3):665–676. doi: https://doi.org/10.1017/S0033822200057829

Orsovszki G, Rinyu L. 2015. Flame-sealed tube graphitization using zinc as the sole reduction agent: precision improvement of Environ MICADAS ^{14}C measurements on graphite targets. Radiocarbon 57(5):979–990. doi: https://doi.org/10.2458/azu_rc.57.18193

Reimer P, Austin W, Bard E, Bayliss A, Blackwell P, Bronk Ramsey C, Butzin M, Cheng H, Edwards R, Friedrich M, et al. 2020. The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). Radiocarbon 62(4):725–757. doi: https://doi.org/10.1017/RDC.2020.41

Rinyu L, Molnár M, Major I, Nagy T, Veres M, Kimák Á, Wacker L, Synal H-A. 2013. Optimization of sealed tube graphitization method for environmental ^{14}C studies using MICADAS. Nuclear Instruments and Methods in Physics Research B 294:270–275. doi: http://dx.doi.org/10.1016/j.nimb.2012.08.042

Rinyu L, Orsovszki G, Futó I, Veres M, Molnár M. 2015. Application of zinc sealed tube graphitization on sub-milligram samples using Environ MICADAS. Nuclear Instruments and Methods in Physics Research B 361:406–413. doi: 10.1016/j.nimb.2015.03.083

Ruttkay M. 2015. Využitie leteckej prospekcie a skenovania pri výskume hradísk a ich zázemia na západnom Slovensku. In: Pieta K, Robak Z, Jakubčinová M, Vangľová T, Turčan V, Csütörtöky J, Lukačka J, Kohút M., Ozdín D, Janošík J, Farkaš Z, Bartošková A, Čižmář I, Kohoutek J, Galuška L, Hanuliak M, Karo Š, Knific T, Ruttkay AT, Ungerman Š, Dorica J, Ruttkay M, Henning J, Heussner KU, editors. Bojná 2. Nové výsledky výskumov včasnostredovekých hradísk. Nitra 2015:297–333.

Schneider RJ, McNichol AP, Nadeau MJ, Reden KF. 1995. Measurements of the Oxalic Acid II/Oxalic Acid I ratio as a quality control parameter at NOSAMS. Radiocarbon 37(2):693–696. doi: https://doi.org/10.1017/S0033822200031210

Stuiver M, Polach H. 1977. Reporting of ^{14}C data. Radiocarbon 19(3):355–363.

Veliačik L., Romsauer P. 1994. Vývoj a vzťah osídlenia lužických a stredodunajských popolnicových polí na západnom Slovensku. I. Katalóg. Archaeologica Slovaca Monographiae Catalogi, Tomus VI. Nitra: Archeologický ústav Slovenskej akadémie vied.

Vendtová V. 1962. Nitra—Lupka. Výskumná dokumentácia 892/62. Nitra: Archeologický ústav Slovenskej akadémie vied.