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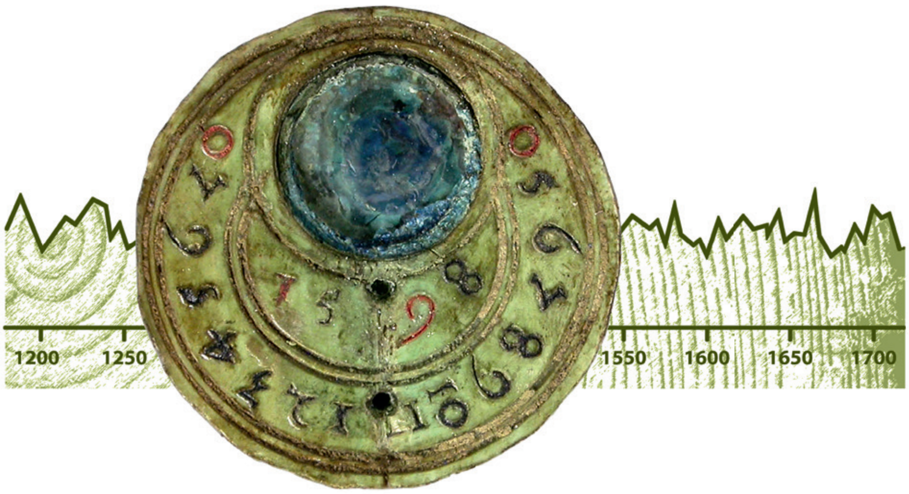
Laufzeit/Zeitlauf

Zeitkonzepte – Datierung – Chronologie in der Mittelalter- und Neuzeitarchäologie

Beiträge der internationalen Tagung in Graz

20. bis 23. September 2016



ÖGM

Österreichische Gesellschaft für Mittelalterarchäologie

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Graz (Universität Graz, Campus), 20. bis 23. September 2016

Die Tagung wurde von der Österreichischen Gesellschaft für Mittelalterarchäologie in Kooperation mit folgenden Institutionen veranstaltet:

Institut für Archäologie der Universität Graz
Bundesdenkmalamt, Abteilung für Archäologie
Institut für Urgeschichte und Historische Archäologie der Universität Wien
Institut für Realienkunde des Mittelalters und der frühen Neuzeit, Universität Salzburg
F.I.A.L.E. – Forschungsgruppe zur interdisziplinären Aufarbeitung landeskulturellen Erbes

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Beiträge der internationalen Tagung in Graz,
20. bis 23. September 2016

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Vorwort

Der vorliegende Band der „Beiträge zur Mittelalterarchäologie in Österreich" enthält die schriftlichen Fassungen von Vorträgen, die im Rahmen der Tagung „Laufzeit/Zeitlauf. Zeitkonzepte – Datierung – Chronologie in der Mittelalter- und Neuzeitarchäologie" vom 20. bis 23. September 2016 an der Universität Graz gehalten wurden. Obwohl Zeit die elementare Kategorie der Archäologie ist, gibt es jedoch kaum eine Tagung, die – beziehungsweise kaum ein Forschungsprojekt, das – sich auf der Ebene unterschiedlicher methodologischer und theoretischer Grundlagen mit dem Thema Zeit auseinandersetzt. Die Konferenz, die in Kooperation mit dem Institut für Archäologie der Universität Graz, der Abteilung für Archäologie des Bundesdenkmalamtes, dem Institut für Urgeschichte und Historische Archäologie der Universität Wien, dem Institut für Realienkunde des Mittelalters und der frühen Neuzeit der Universität Salzburg sowie dem Verein F.I.A.L.E. – Forschungsgruppe zur Interdisziplinären Aufarbeitung landeskulturellen Erbes veranstaltet wurde, stellte Zeitkonzepte aus archäologischer und aus vormoderner-zeitgenössischer Sicht in den Fokus und widmete sich – wie der Titel der Tagung schon suggeriert – zwei auf den ersten Blick sehr unterschiedlichen Fragen von „Zeitkonzepten":

Im Themenkreis „LAUFZEIT" standen methodische Überlegungen zu Datierungsansätzen, Chronologiesystemen und letztendlich Fragen der historischen Deutbarkeit von Veränderungen materieller Objekte in diachroner Betrachtung im Vordergrund. Im Themenkreis „ZEITLAUF" ging es um die theoretische und methodische Reflexion der archäologischen Erkennbarkeit und Interpretierbarkeit von „Temporalität", das heißt, des vormodernen Zeiterlebens, zeitgenössischer Zeitdeutungen sowie Zeitkonzepte. Grob gesagt ging es somit um das Denken IN zeitlichen Kategorien und das Denken ÜBER zeitliche Kategorien, beides letztendlich noch durch zeitliche Ordnungen – nämlich die Epochenverständnisse des Mittelalters und der Neuzeit – gerahmt.

Gerade Letzteres – ÜBER Zeit nachzudenken, ist aber gemäß Immanuel KANTS „Transzendentaler Ästhetik" nicht möglich, weil die Kategorien „Raum" und „Zeit" a priori existieren, das heißt, für uns nicht verfügbar sind, und zwar weder im Handeln, noch im Denken. Einen Lösungsansatz für dieses Problem bietet der Kulturtheoretiker Ernst CASSIRER: Zwar kann man über Raum und Zeit nicht sprechen, sehr wohl aber über Umgang mit Raum und Zeit, das heißt, wie das „Unverfügbare" scheinbar verfügbar gemacht wird: Analog zu CASSIRERS Begriff der „Raumordnungen" ließe sich hier der Begriff der „Zeitordnungen" einführen: Angewandt auf die Hauptthemen der Tagung ließen sich die Fragen nach CASSIRER folgendermaßen formulieren: Wie lässt sich Vergangenheit sinnvoll beschreiben und deuten? Wie wurde Zeit in der Vergangenheit wahrgenommen, eingeordnet und „verfügbar" gemacht?

Raum und Zeit werden somit Kategorien, um kulturelle Phänomene zu beschreiben und zu verstehen, wobei wir uns dabei die Prozesshaftigkeit menschlicher Interaktion (Mensch-Mensch, Mensch-Objekt) zunutze machen. Dies wird insbesondere in der Archäologie deutlich: In dieser sind Raum und Zeit sowohl im Sinne der Stratigraphie als auch aus der Perspektive der materiellen Spuren menschlicher Praktiken direkt aufeinander bezogen. Als Archäologen benötigen wir eine Zeiteinteilung, eine Chronologie, um die materielle Kultur, die Hinterlassenschaften vergangener Gesellschaften zu gliedern und zu ordnen beziehungsweise Entwicklungen und Wandel zu beschreiben und menschliche Gesellschaften zu interpretieren.

Dabei bedienen wir uns besonders gerne und intensiv spezieller Visualisierungsinstrumente menschlichen Handelns in Raum und Zeit, wie beispielsweise der Harris-Matrix, Seriationen, Zahlenstrahlen und vieles anderen mehr: Für sie alle gilt, dass diese Modelle auf die Konzepte „absolute Zeit" und „absoluter Raum" rekurrieren: In einem unendlich gedachten Raum-Zeit-Gefüge werden Phänomene grafisch repräsentiert. All diese Visualisierungen und ihre „Kanonisierung" im Fach sind das Ergebnis komplexer Ausverhandlungsprozesse, denn keine präsentiert „historische Wirklichkeit" per se, sondern es handelt sich um Übersetzungswerkzeuge und somit um interpretatorische Hilfsmittel, nicht mehr, aber auch nicht weniger.

Was müssen Chronologiesysteme erfüllen, um erfolgreich zu sein?

- Es bedarf der Akzeptanz der „Passgenauigkeit" des Modells gegenüber den zu analysierenden Phänomenen
- Es bedarf der Akzeptanz der Übertragungsmethodik: Ist das Modell „repräsentativ"?

- Das Modell muss sich als Analysemodell für konkrete Fragestellungen bewähren: „Wofür ist es gut"?

Aus diesen Kriterien wird klar, dass kein Chronologieschema respektive keine Epochengliederung für sich den „Allerklärungsanspruch" besitzt. Dies zu reflektieren, ist von Bedeutung, entwickeln Chronologien aus fachpolitischer und fachgeschichtlicher Perspektive doch durchaus auch gerne „Eigenleben": Sei es als Definitionskriterium in Stellenausschreibungen, in Fachzweigen, letztendlich auch in der Definition von Gesellschaften, wie eben auch jener der „Österreichischen Gesellschaft für Mittelalterarchäologie": Somit wird klar, dass „Zeitordnungen" nicht nur zur Analyse vergangener Gesellschaften geeignet sind, sondern auch zur Selbstreflexion gegenwärtiger Strukturen dienen können, ja sollten: Auf unser Fach bezogen geht es um eine wissenschaftliche „Kultur des Zeitumgangs" im Sinne eines Offenlegens der Grundlagen, mit denen wir in konkreten Institutionen und Forschungsnetzwerken zeitliche Rahmen setzen.

Aus der Kant'schen Prämisse der Unverfügbarkeit der Zeit lässt sich eine zweite Feststellung ableiten: Zeit wird für uns im unmittelbaren Erleben fassbar und somit auch interpretierbar: Wir leben und agieren IN der Zeit wie auch IM Raum. Durch die verwendeten Verben ist auch schon zwangsweise eine zeitliche Komponente einbezogen, die von uns nicht beeinflussbar ist. Zwar können wir manche Dinge kürzer oder länger tun, aber wir tun es in der fließenden Zeit. Zeit ist scheinbar unveränderbar, stets gleich ablaufend, Sonnenlauf oder auch Mondlauf bestimmen eine Gliederung, eine Unterteilung, für uns Tag, Woche, Monat und Jahr. Der Sonnenstand, die Witterung und die Vegetation sind in den unterschiedlichen Jahreszeiten veränderlich und gliedern das Jahr. Möglich ist auch eine Gliederung durch Rituale, Feste oder bestimmte Lebensabschnitte. Andererseits wird Zeit höchst unterschiedlich wahrgenommen. Zeit beziehungsweise Zeiterfahrung ist sicherlich kulturell determiniert und verschieden. Zeit kann in unserem Empfinden schnell vergehen, manchmal meinen wir aber auch, die Zeit geht kaum vorbei. Die Einführung von bindenden Zeitmessungen hatte massive Auswirkungen auf gesellschaftliche und wirtschaftliche Gefüge und wird auch als Zeichen von Macht verstanden. Vorhandene Zeitmessungen führen dann auch zu einem Aufschreiben, und damit zur Dokumentation von Zeit, eines Momentes, eines Datums, der geschichtlichen Verortung eines Ereignisses.

Doch auch die materiellen Hinterlassenschaften sind in vielerlei Hinsicht zeit-gebunden:

- Dinge sind Kinder der Zeit: Ihre Materialien, Formen und letztendlich auch ihre Zwecke und Bedeutungen sind kulturell gebunden und bieten sich erst dadurch als Quellen zur Interpretation von Vergangenheit an. Ihre Existenz löst aber auch Kausalitäten aus, sei es den Drang des „Auch haben Wollens" bis hin zur Umdeutung, Neukontextualisierung etc. All dies sind Aspekte dessen, was in den letzten Jahren unter dem Begriff der „Affordanz" neue Aspekte von Mensch-Ding-Beziehungen sichtbar und somit erforschbar gemacht hat. Auch Fragen nach Objektbiografien sind in diesem Zusammenhang zu stellen.
- Dinge strukturieren Zeit, und zwar auch jenseits der oben genannten Uhr: Dinge haben eine spezifische Produktionsdauer und Haltbarkeiten, sie wirken sich auf zeitliche Prozesse anderer Objekte und Substanzen aus: Eine Suppe kühlt im Teller schneller aus als in der Tasse. Die Zeitlichkeit von Mensch-Ding-Beziehungen lässt sich auch in der unterschiedlichen Aneignung von Fertigkeiten im Umgang mit Dingen erforschen, die nicht nur vom unterschiedlichen Geschick der Personen, sondern eben auch von der Usability der Dinge abhängig ist.
- Betrachten wir diese zeitlich gebundenen Mensch-Ding-Beziehungen genauer, so zeigt sich, dass manche eher als „events", wie beispielsweise die Herstellung derselben, manche eher als Prozesse, wie der Umgang mit selbigen im Gebrauch, anzusehen sind. Es kommt somit nicht nur auf die zeitliche Kontextualisierung der Dinge selbst an, sondern auch auf die „Spuren von Zeit", wie sie beispielsweise Gebrauchsspuren darstellen, um zeitliche Phänomene an und mit Dingen besser zu verstehen.
- Dinge strukturieren Zeit aber auch in der Wissenschaft: Davon können alle ein Lied singen, die sich schon einmal der Herausforderung der Bearbeitung von Massenfunden stellten. Zeitlich aufwändig sind aber durchaus auch die Deutungsversuche enigmatischer Objekte (so genannter UFOs – unbekannter Fundobjekte, ein Begriff, der von Harald Stadler geprägt wurde).

All dies unterstreicht das enorme Potenzial, mit materieller Kultur Phänomene der Temporalität zu untersuchen. Zwar untersuchen wir als Archäologen rückwärtsgewandt insbesondere langfristige Entwicklungen, seltener versuchen wir aus einem historischen – mittelalterlichen – Blickwinkel heraus, deren zukünftige Perspektiven, Hoffnungen und Erwartungen zu untersuchen. Dies ist umso erstaunlicher, da wir Menschen in unserem sozialen und gesellschaftlichen Umfeld stets die Zukunft vor Augen haben, wir richten unser Dasein auf die Zukunft aus. Wir richten unser Planen und Agieren auf das Morgen, auf die kommende Woche, kommende Jahre, auf die nächste Tagung, auf unsere Zukunft aus, ohne jedoch die Vergangenheit zu vergessen, zu negieren. Ohne die Erinnerung, ohne die Erfahrungen, die wir in der Vergangenheit gemacht haben, ist ein Leben in der Gegenwart, in der Zukunft nicht möglich. Der Versuch einer Verknüpfung der Vergangenheit mit der Gegenwart und der Zukunft ist ebenfalls eine Charakteristik menschlicher Gesellschaften – der Bezug auf die Vergangenheit legitimiert das gegenwärtige und zukünftige Handeln. Zudem betonen die Kollegen der historischen Fächer gerne die Relevanz der Vergangenheit für eine Zukunft.

Zuletzt sei an dieser Stelle ebenfalls noch einmal der Rückblick gewagt, und zwar im Dank an all jene, die die Tagung und in weiterer Folge den Tagungsband ermöglicht haben: Unser besonderer Dank geht an das Team, das in Graz die praktische Durchführung und Tagungsorganisa-

tion vor Ort durchgeführt hatte, insbesondere an Levente Horváth, Johanna Kraschitzer, Iris Koch und Astrid Steinegger. Wir danken weiters allen Subventionsgebern, allen voran der Universität Graz, dem Land Steiermark (Abteilung 8, Referat für Wissenschaft und Forschung) und dem Land Niederösterreich, Abteilung Wissenschaft und Forschung), die durch ihre Förderungen Konferenz und Publikation ermöglicht haben. Last, but not least gilt unser Dank allen Autorinnen und Autoren sowie dem Redaktions- und Layoutteam, die aus einer erfolgreichen Tagung eine hoffentlich ebenso erfolgreiche Publikation gemacht haben. Möge sie auf große Resonanz stoßen!

Die Herausgeber

Wien, im Februar 2018

Beiträge zur Mittelalterarchäologie
in Österreich 33/2017, S. 125–136

Dating with Water? Correlation of Water Level Trends and Construction Periods based on Archaeological Data from the Region of the Danube Bend, Hungary

Orsolya Mészáros, Budapest

Summary

The present paper is an overview of the results of archaeological, sedimentary and hydroclimatic investigations, which provided information on the correlation of water movements – both subsoil water and that of the river Danube – and the reaction of society by changing settlement organisation and building structures. The information is mainly available for three urban settlements of the Danube Bend, Hungary – Visegrád, Nagymaros and Vác. All belonged to the core of the medieval Hungarian Kingdom as royal or ecclesiastical centres. The examined periods are the zenith of Hungarian urban settlements from the 13th to the 16th century and the period of the Ottoman wars from the 16th to the 18th century.

Keywords: River Danube, medieval climatic optimum, climatic change, environmental change, river flood activity, settlement structure change, Little Ice Age

1. Introduction

This paper aims to reveal the correlation between water movements – both subsoil water and that of the river Danube – and changes of structures in the medieval urban environment of three towns of the Danube Bend, Hungary – Visegrád, Nagymaros and Vác – from the 13th to the 18th century. Although the scientific literature sees the 16th century as of key importance in studying and understanding medieval and early modern Danube floods and riverbed movements – based on documentary, archaeological and sedimentary evidence – most of the processes began earlier, in the 14th and 15th centuries. In the following study archaeological observations will be presented from these centuries, from the late Middle Ages to the modern period. Since our last publication on the topic, new systematic overviews – mostly on documentary evidence of the 11th–16th-century Danube floods in the Carpathian Basin – have become available in published form. We will thus attempt to build on these studies and make a more detailed interpretation of the archaeological data from the Danube Bend region.[1]

The three towns, Visegrád, Nagymaros and Vác are situated at the core of Hungary, on the bank of the river Danube. The Danube played an important role in the urban development of the three towns. In the Middle Ages they belonged to the region called *Medium regni* meaning the central part of the medieval Hungarian Kingdom. The Latin term was frequently used by contemporary Hungarian chronicles and charters. This area, situated along the great bend of the Danube, was a possession of the native ruling dynasty (the Árpád-dynasty). Early royal seats developed there during the foundation of the Christian state in the 11th century.[2]

2. Features of the examined settlements

The origins of the urban history of the three settlements go back to the early decades of the foundation of the Hungarian state in the 11th century, even if they have pre-medieval antecedents. In the last decades large-scale archaeological surveys were carried out in all three settlements, prompted by town centre reconstructions or private investments. The surveys yielded mostly archaeological topographic data on the historical towns.

[1] This study is partly based on an earlier publication (Mészáros and Serlegi 2011) with more data on the region of the Danube Bend. The earlier study (Mészáros and Serlegi 2011) was a comparative analysis of the reconstruction of certain environmental (hydroclimatic) and settlement pattern changes in still-water (Lake Balaton) and flowing-water (river Danube) environments in Western Hungary. The present study focuses only on the river Danube. Some of the new published materials on the river Danube, from Lower Austria through the region of Bratislava (Slovakia) to the Danube Bend and Budapest (Hungary): Kiss 2011, Kiss 2012, Kiss and Laszlovszky 2013a, Kiss and Laszlovszky 2013b, Vadas 2013, Brázdil et al. 1999.

[2] Kumorovitz 1971; Altmann et al. 1996; Szende 2010; Végh 2011.

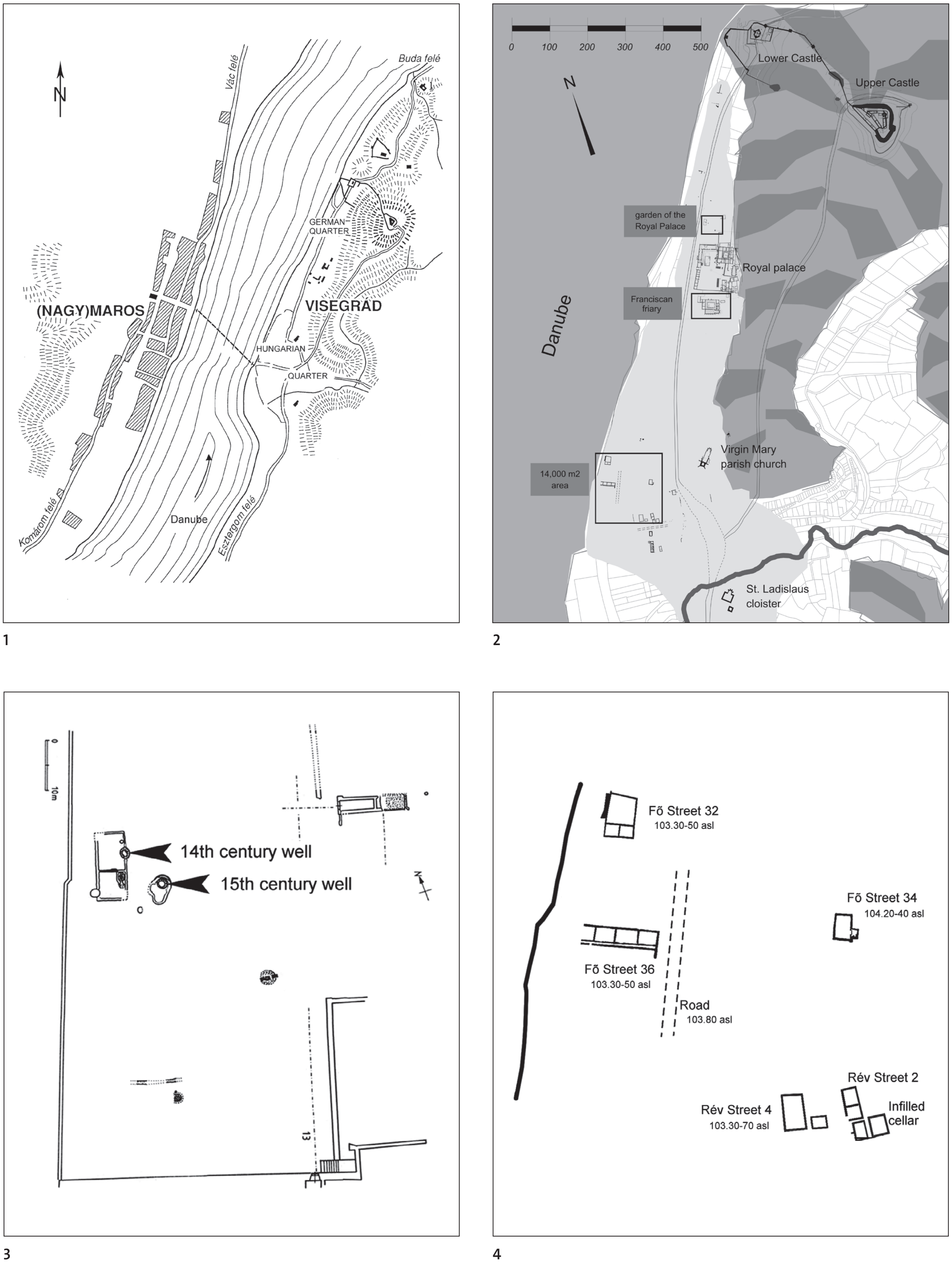

Fig. 1 Visegrád and Maros in the late Middle Ages. **1:** Visegrád and Nagymaros. – **2:** The areas observed in Visegrád mentioned in the text. – **3:** The garden of the Royal Palace. – **4:** The 14,000 m² area with the stone buildings.

Despite the fact that all the three towns are riverside settlements, their geomorphologic positions are different. Vác can be characterised by its heterogeneous geographical situation: it is placed at the junction of mountains and river plains, and the intersection of two trading routes (the waterway of the Danube and the east Hungarian mainland road). Visegrád and its paired settlement on the opposite riverbank, Nagymaros (its medieval name was Maros) were situated on the banks of the river in the narrow Bend of the Danube, surrounded by the steep slopes of hills. The geomorphologic position was homogeneous and disadvantageous in contrast to Vác: the river was the only significant way to approach the town, a factor which was not good for the economy of the settlement. The establishment of all three settlements is definitely connected to the young Hungarian state. The town of Vác was established in the 11th century; in the second half of the century it became an episcopal see. A pre-urban settlement developed at the castle of the bishop, which later gave way to the market of the north-eastern trading route and the waterway. Vác endured the Mongol invasion in 1241, after which the bishop settled a German population in the town, which promoted foreign trade. This led to an economically prosperous period which is dated to the 14th–15th centuries.[3] The medieval history of Visegrád is also connected to the turn of the millennium; the Roman fort at the northern edge of the present settlement was rebuilt as a castle which became the centre of the bailiff and the dean. After the Mongol invasion in the mid-13th century, a new and much stronger stone castle was built by the queen, below which a pre-urban settlement was founded. As in Vác, a German population was settled here by the monarch. The town's highpoint is the 14th century, when the monarch chose the settlement as the seat of the kingdom. Maros, the paired settlement of Visegrád was a smaller place. On considering the central role of these towns, we can establish that all of them were ecclesiastical and royal centres and that the ensuing privileges enhanced their economic role as well. Although the cities flourished at different times, they remained privileged towns throughout the Middle Ages with special economic, legal and ecclesiastical rights.[4]

Academic research into the settlements, both historical and archaeological, began at the turn of the 19th and 20th century. The research concentrated on monuments still standing today (the royal castles and palace in Visegrád, the episcopal castle in Vác) while urban archaeology started after the mid-20th century. The end of the 20th century can be seen as a period of boom: after the breakdown of the communist regimes, Central European countries – including Hungary – attempted to re-interpret their history, also expressing it in the restoration and reconstruction plans of the centres of historical towns. A rapidly growing number of new investments produced new office tower blocks, dwelling houses and underground car parks; this construction activity was preceded by archaeological research. In the last two decades relatively large excavations were carried out in an urban context in the two cities on the Danube Bend, Visegrád and Vác.[5]

The excavations at Visegrád and Vác were located within the historical towns. The excavated areas were in both cases close to the Danube bank and reached great depths. The traces of multiple periods were discovered from the second half of the 13th to the 18th–19th centuries.

In the following the changes in construction and street levels will be described, as will the probably related groundwater level from the 13th to the 19th centuries; afterwards I attempt to reconstruct the medieval water levels of the river Danube and the relationship between the river and the three settlements based on archaeological data.

In Visegrád a 14,000 m^2 area near the river Danube, the present Visegrád-Nagymaros ferry terminal, was excavated between 2003 and 2007. The area is bordered by Road 11, Rév Street, Fő Street and Mozi Lane and is 50–100 m from the Danube. It was part of the 14th-century Hungarian quarter of historical Visegrád, somewhat away from the medieval town centre, but still within the town limits.[6] These data – analysed from the perspective of environmental archaeology – are complemented by further data from two other sites: firstly, the area of the late medieval Franciscan friary; secondly, 14th–15th-century wells in the garden of the Royal Palace. The sites are situated to the north.[7]

In Vác, large-scale excavations were carried out in three locations during the past 30 years, all within the area of the historical German town and the former medieval city walls. In 1986–87 an area of 3400 m^2 was excavated in Széchenyi Street area in advance of a shopping centre.[8] In 2003–2005, the German city centre was excavated at Március 15 Square (1800 m^2)[9] and then, in 2008–2009, in Piac Street, 150 m to the east of Március 15 Square and next to Széchenyi Street, a further site with 3600 m^2 was excavated before the construction of a underground car park.[10] The distance of the sites from the Danube is c. 300–500 m.

3. Data from Visegrád and Maros *(Fig. 1)*

3.1. Visegrád town: rising ground and construction layers, cellar infilling

A long-term process, affecting settlement and building conditions even in the late medieval-early modern peri-

[3] MRT 9. 404–406, 418–422; Kubinyi 1983, 49–76.

[4] Mészáros 2009a, 28–63; 237–249; Buzás et al. 2014, 45–97; Laszlovszky and Szende 2014, 24–45.

[5] Mészáros 2013, 119–121, 125–130.

[6] Gróf and Gróh 2004, 317–318; Szőke 2004, 323–324; Gróf and Gróh 2005, 308; Mészáros 2005, 307–308; Mészáros 2009b, 51–71; Kováts and Gróf 2007, 321–322; Kováts and Gróf 2008, 306–307.

[7] On the Franciscan friary: Buzás et al. 1995; Laszlovszky 2013, Kiss and Laszlovszky 2013a. On the wells in the area of the Royal Palace: Pálóczi Horváth 2006, 38–41, 56–57.

[8] Miklós 1986; Miklós 1991.

[9] Tettamanti 2004, 309; Tettamanti 2005, 299–300; Batizi 2006, 331.

[10] Mészáros 2016.

od, was observed during the urban excavations at Visegrád. Here, a clear rise in the water level of the Danube occurred between the 13th and the 16th centuries. It was first detected by Miklós Héjj. His investigations of settlement development, based on the excavations of the medieval royal centre and civil town of Visegrád, suggested a long-term rise in Danube (high or flood) water levels (in its Danube Bend section) from the 13th century onwards.[11] This theory is strengthened by the following detailed analysis.

The 14,000 m² area at Visegrád was generally characterized by a thick modern fill. The cultural layers under the fill were in continuous use from the 13th to the 16th centuries, but were not built up very densely, at least not with permanent stone buildings. The medieval function of the area is not entirely clear yet, and a connection with the marketplace has been suggested based on the presence of roads and ovens, the lack of permanent domestic structures and the suitable location at the riverside opposite the medieval market place of Maros. The modern level of the area is around 105.40–106.40 m asl, while the modern mean water level of the Danube fluctuates around 99.43 + 1.5–2.0 m asl.[12] The medieval layers were 2–3.5 m under the above-mentioned level. Medieval layers included a dark brown humus layer and a yellow clayey layer below it; both were rich in finds. The features and finds of the period were located here, in a 60–150 cm thick sequence of layers. The average medieval level of the area was 103.60 m asl, but the occupation layers showed a wider range between 102.90 and 104.40 m asl. The remains of two stone buildings from this period were uncovered (Fő Street 32 and 36) at the western edge of the present area, very near the Danube and partly under the present Road 11 – which currently also serves as a dam. The buildings, which had no cellars, served as houses, and later as workshops in the 14th–15th centuries. The level of the floors of the two buildings was around 103.30–103.50 m asl, which is 3 m deeper than the level of the highest point of Road 11. The floor level of another medieval building in the eastern edge of the excavation area, further away from the Danube (Fő Street 34), was approximately one metre higher (104.20–40 m asl) than the previously mentioned buildings. At the southern edge of the area (Rév Street 4) the 14th-century floor of the building was at the same level as the medieval floors near Road 11 (103.30–70 m asl). The area closer to the Danube was crossed by a north-south oriented, wide, find-rich pebble layer, which most probably had been a road. Its depth is the same as that of the surrounding buildings: 103.80 m asl. Thus, the entire 14,000 m² area was characterized by a slight slope rising from the Danube, from west to east.[13]

The southern edge of the 14,000 m² area is the plot of Rév Street 2, still in the territory of the medieval town. Flood-related evidence has been recently published here. At this site (a present-day schoolyard) a 14th-century building was excavated beneath the 18th-century features. The cellar of this late-medieval building was filled in at the end of the 15th or beginning of the 16th century, presumably due to flood problems. This theory of the excavating archaeologists was supported by the fine sediment (mud) layers brought in by flood water, found in the same cellar underneath the artificial infill.[14]

3.2. Visegrád urban royal foundations: Franciscan Friary and Royal Palace garden

Medieval features related to subsoil water movements and Danube floods were detected c. 500–800 m north of the 14,000 m² area. The area of the Franciscan friary, built in the 1420s and located close to the Danube on a gentle slope, provides us with further evidence. First is the general rise in ground levels, a process which can be detected clearly from the 14th century: the remains of the earlier settlement (at the turn of the 13th–14th century) were located around two metres underneath the friary, particularly under the cloister. When the friary was founded in the 1420s, a large (double-)cellar was built on the western (Danube) side of the cloister: one room under the kitchen and the other under the refectory. In this case, the builders raised the ground level to compensate for the slope of the terrain. At the same time, the floor level of the previously mentioned double cellar was roughly the same as the floor level of the houses of the 13th–14th-century settlement, which had replaced the Franciscan friary buildings. Second, re-building phases were also detected: one of them took place during the 1470–80s, while the larger, almost total re-building of the complex occurred during the first decade of the 16th century. Another significant rise of the ground level was initiated during this new building activity. As early as this phase one of the two cellars in the western wing, under the kitchen, was filled in with earth and a small new cellar was erected in the eastern wing of the cloister, close to the hill slope, behind the building complex. The other process related to the cellar under the refectory: during the early 16th century the remaining cellar, located on the western, Danube side of the friary under the refectory, was filled in and a new cellar was built on the opposite (eastern) side of the friary in a safer location, carved into the rock of the slope of the hill and far from the river. Nevertheless, in the first half of the 16th century (between 1514 and 1540) something (serious) happened with the environment of the friary, when one part of the building, namely the northern cloister walk (with pavement, pillars, vaulting etc.) sank one metre. The Gothic vault of the corridor collapsed because of this great change.[15]

Based on these features, the location of the friary, the stratigraphy and morphological conditions of the area, it is presumed that this major damage had strong connec-

[11] Héjj 1988.

[12] Mean water level correlated with the zero point of the Danube floodometer at Nagymaros. (http://www.hydroinfo.hu/vituki/archivum/nm.htm) [Access: 30.06.2017]

[13] See footnote no. 6.

[14] Buzás et al. 2006, 262.

[15] Kiss and Laszlovszky 2013a, 5–7.

tions to Danube floods which took place around the same time, and also to the generally rising trend of Danube water levels.[16]

Around 200–300 m to the north, in the area of the garden of the Royal Palace, two wells predating the establishment of the royal garden are important as signifiers of environmental change. The depth of the earlier, 14th-century well from the reign of Louis I was 4.61 m below the modern surface and 3.41 m below the medieval surface. The amount of water in the well was determined by the changes of the water level of the Danube, and according to the excavator the height of the water column in the well fluctuated between 1 and 1.7 m. Afterwards, at around the end of the 14th century, during the reign of Sigismund, this well was filled up and a new well was dug nearby. The depth of the water was 5.16 m from the modern surface and 4.2 m from the medieval surface. The excavator estimated the height of the water column in the well to be 1–2.2 m, depending on the water level of the Danube. The depth of the wells shows the deep subsoil water tendency in the 14th century connected to the low terrain level of the 13th–14th century settlement remains under the cloister of the Franciscan friary. Nevertheless data from the palace garden do not indicate a significant increase in its level during the late Middle Ages, which was, however, the result of continuous maintenance and planned levelling.[17]

3.3. Nagymaros

Similar phenomena to the observations in Visegrád can be expected in the same periods at Nagymaros, on the other side of the Danube. Archaeological data from Nagymaros only partly corroborate the observations at Visegrád, although Nagymaros is less well investigated archaeologically. A test trench was opened in 1978 within the centre of the settlement, on Kossuth Square, which is not far from the river Danube, to examine the sequence of archaeological layers. Medieval layers going back to the 11–13th century were observed at a depth between 130–150 cm and 70–80 cm. With the modern street level of Kossuth Square at 107.31 m asl, the medieval layers were found between 106.60 and 105.80 m asl. The humus cultural layer was interrupted at a depth of c. 100 cm (106.20 m asl) by a layer of pebbles mixed with yellow clay, which was probably a trace of a Danube flood. Below the layer of pebbles late medieval sherds from the 14th–15th century were found, as were coins from the reign of Sigismund and Matthias Corvinus (15th century).[18]

3.4. Conclusion of the observations at Visegrád

Summing up the results from Visegrád, the stone buildings, habitation layers and wells reflect the altitude of the 13th–16th-century buildings and subsoil water sources. The most important conclusion is that the floor level of the buildings and the street level were 2–3 m lower than today, especially in the areas closer to the Danube. Such a great difference could not be observed in the areas, farther away from the riverside however (town centre, hillside, palace garden, here on average 0.5–1.5 m), so that we have to assume a steeper terrain between the Danube bank and the hillside than today. Since the above-mentioned stone buildings served as dwelling houses and workshops (with ovens for handicrafts), as the archaeological material shows, they had to be placed in areas not affected by floods. The layers do not indicate frequent flooding, thus the buildings probably stood in a dry area throughout this period. The stone houses were built in the 14th century, at the time when the settlement became a free royal town, the town was well-populated and its limits were extended; the buildings were continuously inhabited until the Ottoman Period, around the mid-16th century. Thus we may assume that these domestic structures and fire-using workshops were built in an area not affected by flooding. This observation leads to the conclusion that not only the groundwater, but also the level of the Danube, must have been lower than today.

In the case of the Franciscan friary, the following conclusions were drawn on the basis of the excavated features. Contrary to the observations of the town centre, we can establish a more precise ground-level rise during the 300-year long period. The building process of the friary in the 1420s was preceded by a significant ground-level rise compared to the previous ground level of the 13th–14th-century buildings. It was probably necessary because of the long-term rise in Danube (flood) water levels. The great flood events of the 1500s and/or the floods of the late 15th and early 16th-century flood peak as well as the long-term water-level rise had a clear impact on the early 16th-century rebuilding processes in the form of a significant rise in the ground level, and also in the infilling of the cellars located close to the Danube.[19]

The data from Maros differ from the phenomena observed at Visegrád in two points. A great difference between the modern and medieval levels as at Visegrád could not be observed at Nagymaros. The thick modern fill at Visegrád, however, was characteristic only of the areas close to the river bank; further away, at a distance of 100–150 m the difference between these levels – that is the thickness of the fill – decreased. The test trenches excavated at Nagymaros were not located on the Danube bank, but 170–250 m away, thus they do not differ significantly from the situation at Visegrád. The flood layer observed at Nagymaros did not occur at Visegrád. This is explained

[16] For the floods of the river Danube in the 15th and 16th century, from the Bavarian and Lower Austrian section of the Danube to Bratislava (Slovakia) and Budapest, see: Kiss and Laszlovszky 2013a, 2–4; Kiss and Laszlovszky 2013b, 44–58.

[17] See footnote no. 7.

[18] Pálóczi Horváth 1979, 48–49; MRT 9. 216–219.

[19] Kiss and Laszlovszky 2013a, 5–7.

by the fact that the coins found were underneath the loess layer, meaning that the assumed flood took place after the Matthias period, at the end of the 15th century the earliest, but more probably during the 16th century or the Ottoman Period (16–17th century). At Visegrád, no Ottoman Period occupation could be observed within the area of the medieval town, since it was destroyed during the Ottoman wars.

4. Data from Vác *(Fig. 2)*

Wells, a timber-framed cellar and the general terrain level of the area are the most important features from our point of view from the excavations at Piac Street and Széchenyi Street – the two large area field surveys that are well published and have good information relevant to this topic. The most significant group of features from both environmental and archaeological perspectives was a timber cellar from the turn of the 13th/14th century and a 17th-century well built immediately beside and partly above the cellar *(Fig. 3)*. The data on the levels of these two features separated by 300 years are excellent markers of the changes of groundwater levels and street levels in the surrounding area. The timber structure, of which only the cellar was preserved, was built at the turn of the 13th and 14th centuries, and was definitely in use during the 14th century. Based on its finds, we could establish that it had been filled in and was out of use by the 15th century. We have no data on the building above it. The floor level of the cellar was at 107.98 m asl.[20] It seems that the choice of the location of the well built immediately beside it was accidental; by the time of the construction of the well, the cellar had been filled in and most probably the building above it had disappeared as well. The good state of preservation of the timber cellar was primarily caused by the permanent water supply of the well and the wetness of the soil. It is significant that the bottom of the 17th-century well, which had a mixed timber-stone structure, was almost at the same level as the floor of the earlier cellar just beside it. The bottom of the well was at 107.70 m asl, just 30 cm deeper than the floor of the cellar. The timber-framed, timber-floored cellar must have been built at a depth that was still dry i.e. above the average water table of the 13th–14th centuries. The water of the well obtained at the same depth 300 years later indicates that the groundwater level had significantly increased by this time. It is possible that the filling up of the cellar in the 15th century was necessary because of the gradual increase in the water table.

The same phenomenon has been observed at other excavations during the past decades. The 14th–15th-century wells excavated adjacent to the area of the underground car park, at Széchenyi Street 5–7 and Káptalan Street 2, contemporary with the timber cellar, were much deeper than the above-mentioned 17th-century well. The shaft of one of these was at least 6.2 m deep, its bottom was not found;

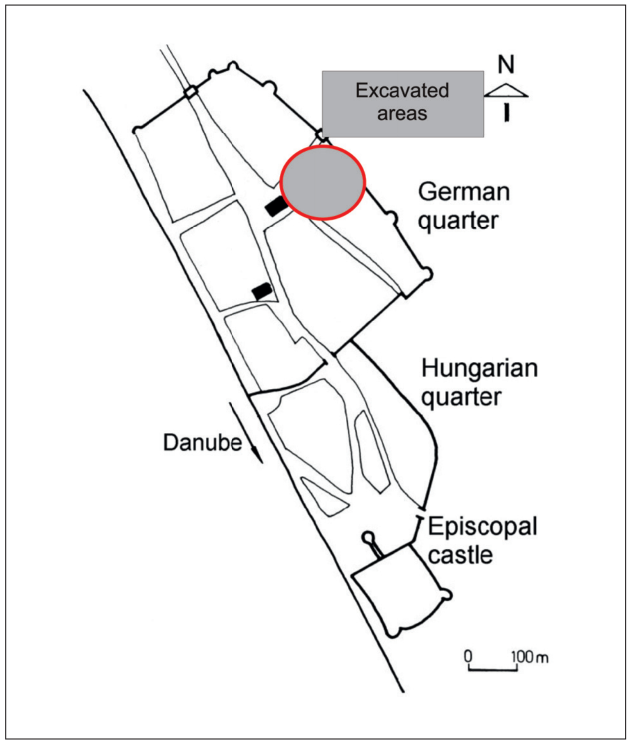

Fig. 2 Vác in the late Middle Ages with the larger excavated areas.

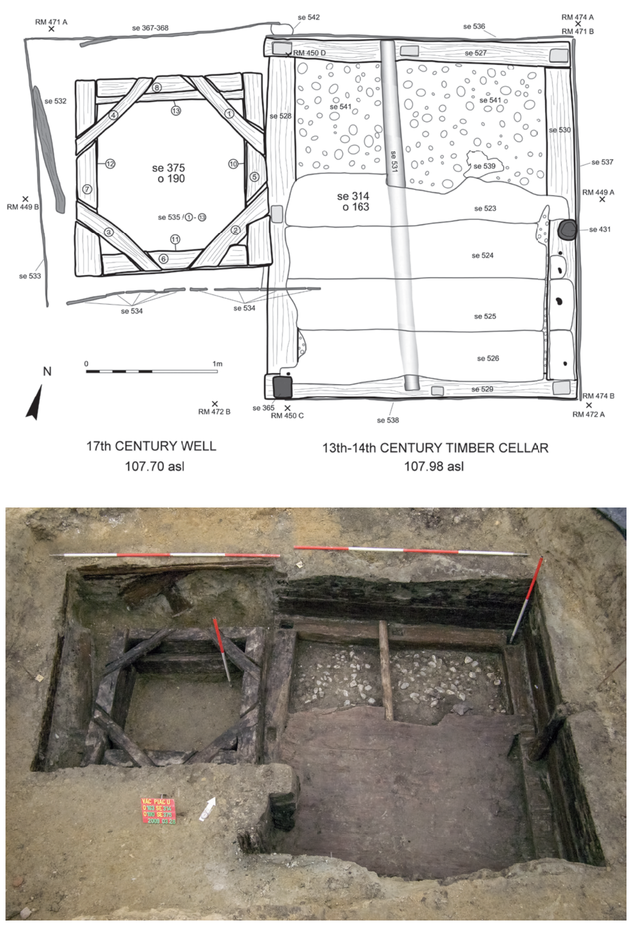

Fig. 3 Vác. Remains of the timber-framed cellar (14th century) on the right, and the well (17th century) on the left.

[20] Mészáros 2010, 180–185; Mészáros 2016, 25–30, 47–48, 448–449.

the bottom of another well was found at 106.54 m asl, 1 m deeper than the 17th-century well and 1.5 m deeper than the bottom of the contemporary cellar.[21]

The plot of Káptalan Street 14, south-east of the area of the underground car park was excavated in the 2009–2010 campaign. The most important archaeological feature of the plot was a stone building and the cellar underneath it dated to the 16th century. Different strata from the 14th–15th century were identified under the building and the cellar, among them the remains of a timber-framed house dated to the turn of the 13th to the 14th century. Detailed analysis of the fieldwork has not been published yet, but according to the excavator the remains of the timber-framed house were found more than two metres deeper than the basement of the 16th century stone building.[22] Although we have no data about the absolute height of the features we can suppose that the habitation layers of the 13th–14th century were at a similar depth as in the area of the underground car park at Piac Street and Széchenyi Street 5–7.

This series of data can be complemented by the 16th–18th-century wells excavated in the area of the underground car park of the Piac utca. The lower row of timbers of a 16th-century well 27 m south of the timber cellar could be dated dendrochronologically. According to this examination the well was constructed in the second half of the 16th century. The bottom of this well was at 108.28 m asl. Compared to the 100–200 years older medieval wells, a significant increase can be observed in the level of the water table: the bottom of the late 16th-century well was 1.7 m higher than that of the medieval ones. Compared to this, however, the bottom of the 17th-century well was again c. 60 cm lower. We know two other wells from the area from the 17th–18th centuries (without any more precise date); both had an excellent timber and stone structure. Their deepest points were at 107.89 and 107.32 m asl. Thus the average depth of the 17th-century well and the two 17th–18th-century wells is 107.09 m asl, somewhat deeper than the shallowest 16th-century well with the shortest shaft. Finally, we have to mention a well of uncertain date, but probably from the 19th century, providing new data different from the others above. The shaft of this well was the deepest of all: 6 m from the excavation surface, but its top consisted of collapsed stones, thus the position of the uppermost row of stones i.e. the rim of the well, is unknown. The bottom of this well, a mixed stone-timber structure, was at 104.54 m asl. This is thus the deepest of the wells known so far, 2 m deeper than the 14th–15th-century ones. This means that the water table decreased significantly after the 16th–18th centuries.

Beside the changes in the depth of wells we have to mention the changes in the medieval street and terrain levels. A gradual increase in the level of the archaeological surfaces could be observed between the 13th and 21st centuries in the area of the underground car park. The surface in the 13th–14th centuries was between 109.80 and 110.30 m asl and the floor of the cellar was 2 m deeper, while the bottoms of the wells were 4–5 m deeper. In the 16th century, the level of the surface did not change, but the rise of the level of the bottom of the wells suggests that the water table was only 1.5–2 m below the average contemporary surface. It was probably due to this small difference that later the level of the terrain was gradually elevated. In the 20th–21st century, the average level of the city centre is around 112.40–115.00 m asl. After the high bottom level of the 16th-century well in contrast with the gradual rise of the surface level, water sources became deeper again, and the difference between the level of their base and the street level became larger. By the 19th century, the difference between the wells (and the water table) and the street level became rather large, 6–8 m. Such a contrast was not observed even during the period of the low medieval water table. By now the water table at Vác has risen again and fluctuates between 109.00 and 113.00 m asl, while the mean water level of the Danube based on the data from Nagymaros is around 99.43 + 1.5–2.0 m asl.[23] Today, in terms of groundwater, Vác is considered an extremely sensitive area. Alongside climatic changes, the groundwater level in the 19th–21st centuries was greatly affected by industrial activities, which, however, is beyond the scope of this paper *(Fig. 4)*.

5. The impact of the observations from the three towns: their relationship to climatic change and the built environment

Fundamental similarities could be observed in the three towns of the Danube Bend. One was the significantly lower level of the medieval, 13th–15th-century terrain compared to the modern one. This level gradually but distinctly increased from the 16th century, connected partly to more frequent floods of the river Danube and the rise of the groundwater level caused by climatic change and partly due to anthropogenic activity, namely landscape reconstruction, resettlement and settlement development in the wake of the Ottoman wars (16th–17th centuries). The low medieval terrain level and its increase in the Ottoman and modern periods had the following impact.

1. In the Late Middle Ages (13th–15th c.), the buildings, cellars, streets and other features of the towns lay 0.5–3.5 m deeper than the modern average terrain level. The water table of the wells was rather deep, 5–8 m below the modern street level. In some areas we could observe more precise – bigger – differences in the habitation layers between the 13th/14th-century and the 14th/16th-century levels (e.g. the cloister of the Franciscan friary). The reason for this is very probably the fact that both in Visegrád and Vác the second half of the 13th century can be described as one of the settlement of new areas on the riverbank, during the

[21] MRT 9. 440–444, 450; Miklós 1991, 15; Miklós 1986, 237.

[22] Rácz 2013, 3–5.

[23] Mean water level correlated with the zero point of the Danube floodometer at Nagymaros. (http://www.hydroinfo.hu/vituki/archivum/nm.htm) [Access: 30.06.2017]

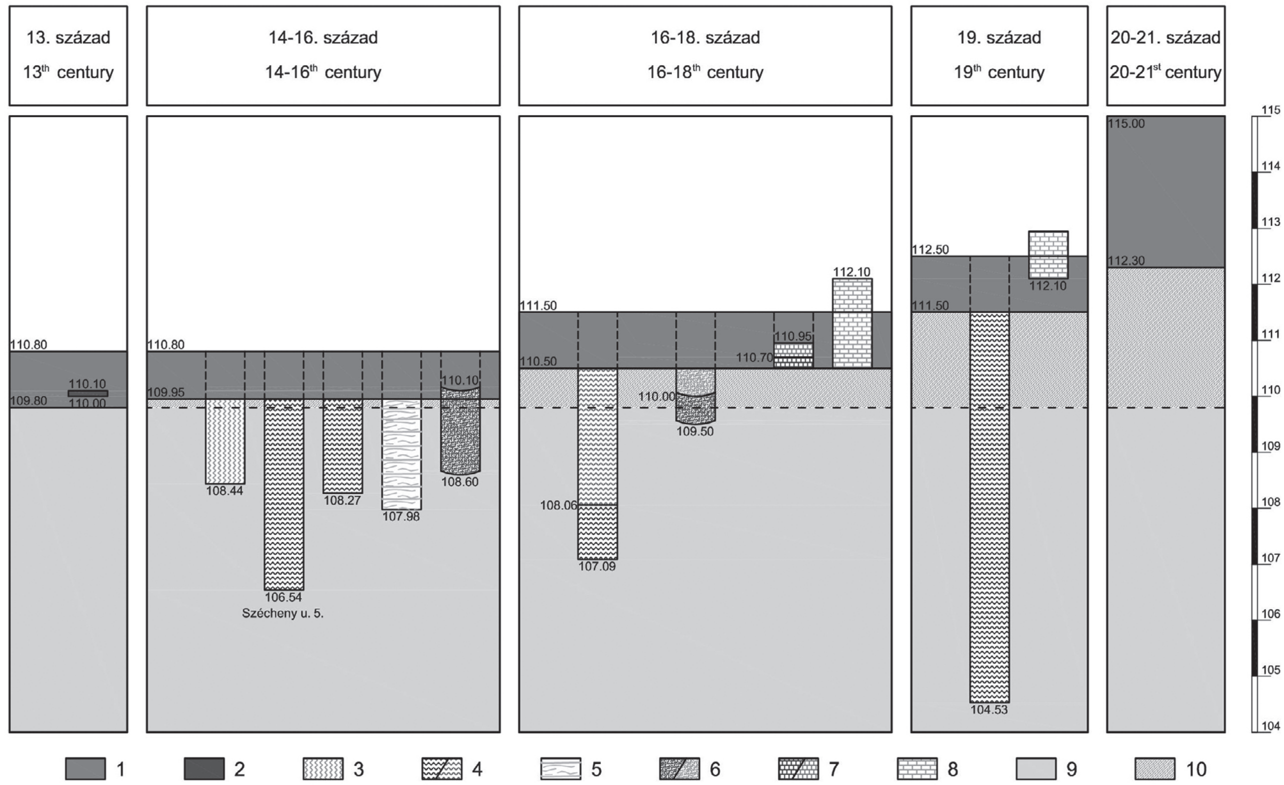

Fig. 4 The schematic cross-section of the site, Piac Street, Vác. 1: floor. – 2: oven. – 3: cistern. – 4: well. – 5: cellar. – 6: pit. – 7: building: 16th century. – 8: building: 18th–19th century. – 9: geological strata. – 10: historic cultural layers.

period of the extension and founding of the towns after the Tartar invasion. The period of the 14th–16th century was the zenith of both towns, with the growth of the population, construction projects and the forming of the new settlement landscape.

2. After the 16th century, a distinct rise of the terrain level can be observed for environmental and historical reasons. All three settlements shifted vertically: the infilling of areas and landscape reconstruction can be observed. Significant ground-level rise could be also detected in the early 16th century in upper sections of the river Danube: in Austria, Slovakia and in the lower quarter at Budapest. Christian Rohr established that after the great flood in 1501 the rising ground levels resulted in new building processes. A good example is the Engelhartzell tollhouse where after the 1501 flood the house had no windows at the ground floor, but only at the first floor.[24] Similarly, a significant rise of yard levels (1.5 m) was reconstructed in Šamorín near Bratislava (Slovakia);[25] and an important (of half a metre or more) ground-level rise could be also observed in the early 16th century at the Dominican nunnery on Margaret Island, Budapest.[26]

3. The lower medieval terrain and water table levels indicate that the average discharge of the Danube was smaller than today and lower flooding activity can be postulated. The average medieval discharge of the river, however, is impossible to estimate with any certainty, since the situation of the river is different at Visegrád-Maros and Vác. At Vác the Danube is alluvial, that is it flows on its own silt, but at the Visegrád Strait it is in direct contact with the base rock. The hard surface of the base rock influences the shape of the river, so that it can be assumed that at this point the changes of discharge were directly reflected in the changes – rise and fall – of the water level of the river. In contrast, at Vác hydrological changes could have changed the shape of the river horizontally as well, through the lateral movement and change of the river bed.[27] Thus it can be only established at these three settlements that the medieval discharge was lower than today, although at Visegrád the water level was probably lower as well.

The archaeological data from Vác, Visegrád and Nagymaros corroborate, indeed in the area under study provide more detail on, the already known characteristics of general climatic phases. The 13th–15th-century data from the Danube Bend fall at the end of the medieval climatic optimum. Although in some regions the features of the subsequent Little Ice Age can be observed as early as the second half

24 Rohr 2005, 74; Kiss and Laszlovszky 2013a, 9; Kiss and Laszlovszky 2013b, 59–60.
25 Urminský 2005; Kiss and Laszlovszky 2013a, 4, 8–9; Kiss and Laszlovszky 2013b, 59.
26 Vadas 2013; Kiss and Laszlovszky 2013a, 4, 7–8.
27 Pišút and Tímár 2009, 56–62.

of the 14th century, according to our data the climatic effects of the Little Ice Age in the Danube Bend region appear somewhat later. The explanation is to be sought not in the climatic characteristics of the area, but in the behavioural mechanism of the Danube as an interregional river. According to the climatic data in the literature, the Little Ice Age was characterized by a slightly decreasing average temperature and increasing precipitation. It was mainly the distribution of precipitation that changed compared to the previous periods, causing a change in the character of the seasons. While the medieval optimum was characterized by a warmer and dryer climate with a winter and summer season, the Little Ice Age is distinguished by a longer winter and a cooler and wetter summer and autumn. One of the most salient features of the climate change in the Carpathian Basin was the change in the amount of precipitation: a prolonged increase is clearly traceable in the precipitation balance.[28] According to the data from the cities of the Danube Bend, the drastic shift in precipitation occurred in the first half of the 16th century. The sudden increase in the groundwater level observed at Vác and the flood layer at Nagymaros can be dated to this period. Both observations indicate a sudden, but at the same time continuous, increase in precipitation – the unfolding of the climatic characteristics of the Little Ice Age. One of the hydroclimatic consequences of the Little Ice Age was the increased magnitude of floods; the increased discharge and slow rise of the water level of the Danube, and the beginning of its riverbed shaping activity can also be placed in this period. Some data indicate that the waters of the Carpathian Basin began a slow increase as early as the Late Middle Ages.[29] The results of Andrea Kiss on floods in documentary evidence suggest that higher flood frequency and intensity periods occurred in the early and mid-16th century; a probably more prolonged period took place in the second half of the 16th century, with a peak in the late 1560s–early 1570s and maybe with another at the end of the 16th century. Earlier flood peaks in documentary evidence were detected on the Danube at the turn of the 14th–15th centuries and in the last decades of the 15th century, continuing in the early 16th century.[30]

Based on the investigations we may establish that the influence of increased precipitation induced by climate change on settlement patterns can be observed in the Danube Bend region. Recent research has shown that the climatic character of the Little Ice Age can be grasped more in its increased volatility and unpredictability than in a general, omnipresent cooling trend.[31] The catchment area of the Danube from its source to the Danube Bend exceeds 300,000 km^2. Changes in its discharge are influenced by the climatic characteristics of many areas. The increased discharge observable through medieval archaeological remains and the transformation of settlement structures in the Danube Bend region were already the result of a more significant, large-scale climatic change. There are numerous sources from this period on the increased flooding activity of major European rivers.[32] It might have been as a result of this process that the more significant human interventions, the significant artificial elevation of the terrain at the settlements of the Danube Bend region, can be dated only to the 16th century. Climate research places the full development of the Little Ice Age in Europe in the 17th century.[33] It is conceivable that the impact of the Europe-wide increase of precipitation was already felt in the 16th century in the catchment area of the Danube and in its discharge. It can be observed that the various types of natural water bodies reacted differently to climatic change. In the case of the settlements of the Danube Bend we cannot expect a continuous rise in the water level of the river. In accordance with fluvial dynamics, periods of large discharge occur seasonally, especially in spring time. If the extent and frequency of the floods of the Danube increased significantly due to a general increase of precipitation, the inhabitants of the river bank had to adjust the house and street levels of the settlement to the temporary highest water level during the flood period. This was most effectively achieved through the heightening of the general level of the area, since in that way they were not cut off from the river during periods of low water levels, but the settlement features remained safe during floods.

To sum up we may establish that we have observed changes of settlement patterns in the Danube Bend area caused by the characteristic climatic changes of the late Middle Ages. The changes in the water level of the river had an effect on the conditions of settlement when precipitation uniformly increased throughout its whole catchment area covering half a continent. Since periods of higher water level and discharge and floods were of temporary character, the settlements reacted to the higher water level caused by increased discharge by above all heightening the terrain, that is through vertical shifts.

28 Rácz 2008, 29–33.
29 Rácz 2008, 33; Pišút and Tímár 2009, 61.
30 Kiss and Laszlovszky 2013a, 10.
31 Mann 2002, 505.
32 Braudel 1986, 270–271; Kiss and Laszlovszky 2013a, 10; Kiss and Laszlovszky 2013b, 56. (for Regensburg, Germany. Here mentioned: Heigel 1878, 14–15, 28, 50, 55, 104–105, 126, 144, 149, 158. Cited by Weikinn 1960, 20, 40, 57, 67, 73, 78, 111, 118, 130, 139, 144.; Glaser 2008, 227. (for Ulm, Germany)
33 Mann 2002, 506; Holzhauser et al. 2005, 793–797.

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Mit Wasser datieren? Korrelation von Wasserstandstendenzen und Bauperioden anhand archäologischer Daten in der Region des Donauknies in Ungarn

Im vorliegenden Aufsatz wird ein Überblick über die Ergebnisse archäologischer, sedimentologischer und hydroklimatischer Untersuchungen im Bereich des Donauknies in Ungarn gegeben. Der Zusammenhang von Wasserbewegungen – des Grundwassers wie auch der Donau – mit Änderungen in der Siedlungsorganisation und sich ändernden Baustrukturen wird dabei untersucht. Die Datengrundlage stammt hauptsächlich aus drei urbanen Siedlungen am Donauknie: Visegrád, Nagymaros und Vác. Sie gehörten zum Kern des Ungarischen Königreichs und waren weltliche oder kirchliche Zentren. Der Untersuchungszeitraum ist der Zenit ungarischer urbaner Siedlungen vom 13. bis zum 16. Jahrhundert und reicht weiter in die Zeit der osmanischen Kriege vom 16. bis zum 18. Jahrhundert.

Schlagworte: Donauknie, mittelalterliches Klimaoptimum, Klimawechsel, Umweltveränderungen, Überflutungen, Siedlungsstrukturänderungen, Kleine Eiszeit

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