DENDROARCHAEOLOGY IN SISAK, CROATIA (SISCIA): ROMAN URBANISM AND *COLONIA* STATUS

A Thesis

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Master of Arts

by

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ABSTRACT

Sisak, Croatia (Siscia) served an important role in the Roman Empire as a military base for further conquest of the Pannonian region under Augustus and Tiberius, and later as a major industrial and economic center. Dendrochronological evidence from Sisak sheds light on urbanism in the city during and after the granting of *colonia* status in the first century CE. Wood collected from various areas at the site has been dated relatively using dendrochronology and absolutely from 160 BCE to 204 +/- 11 CE using radiocarbon wiggle-match dating. The chronology shows an increase in growth directly following the granting of *colonia* status to the city under Vespasian, and thus offers us a glimpse into an important period of Romanization in the early expansion of the empire into the Save river valley toward the Danube.

BIOGRAPHICAL SKETCH

Katherine graduated from Cornell University in 2011 with a B.A. in Archaeology. After graduation she worked in the Malcolm and Carolyn Wiener Laboratory for Aegean and Near Eastern Dendrochronology and she continued working there while completing her coursework for her Master's degree.

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Radiocarbon dates were analyzed by Dr. Eva Maria Wild at the Vienna Environmental Research Accelerator (VERA), Vienna, Austria, and by Dr. Bernd Kromer at the University of Heidelberg Laboratory, Heidelberg, Germany. Many students and colleagues in the Cornell Tree-Ring Laboratory and at the University of Zagreb contributed to the early collection, measurements, and analysis of many samples in the data discussed. I would like to acknowledge Professor Peter I. Kuniholm (former director of the Cornell Tree-Ring Laboratory), Professor Aleksandar Durman (University of Zagreb), and Dr. Carol B. Griggs in particular for their contributions to the project.

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Special thanks to my advisor, Sturt Manning, who has provided me with support and encouragement during my tenure at Cornell both as a graduate student and earlier as an undergraduate and research aide in the tree-ring laboratory. I would also like to thank Caitlín Barrett, Nathan Pilkington, and Carol Griggs for their comments and guidance with my research.

I could not have done this project without Chris Blunda, who has helped in almost all stages of this project. Thank you for listening to me talk about this for two years without complaint, and for being so thoroughly supportive throughout the entire process.

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1. Introduction

1.1 Physical setting

Sisak, Croatia, lies approximately 130 kilometers inland from the coast, and 45 kilometers southeast from Zagreb (Figure 1).[1] Sisak provides evidence for human occupation since at least the Iron Age, due to its position at the confluence of the Odra, Kupa, and Sava rivers, and its proximity to iron resources (Figure 2) (Durman 1992). The city was known to the Romans as Segestica during pre-Roman Celtic occupation, and was conquered in the first century BCE by Octavian and his troops, and thenceforth known in the Roman period under the Latin name of Siscia.[2] The Kupa connects directly with the Sava in Sisak, which empties into the Danube near modern Belgrade. The Sava basin offered fertile land easily accessible by the river, and provided a valuable route into the region for the Romans.

The Save valley was a major site of Roman expansion in the early Empire under Augustus and Tiberius (Gruen 1996; Mócsy 1974, pp.112–4; Šašel Kos 2010; Whittaker 2000, pp.296–8), and evidence from Siscia gives us a glimpse into the ongoing imperial interactions with the local inhabitants of the region. Rome's successful integration of new territories and their peoples was vital to the prosperity and persistence of the empire (cf. Garnsey & Saller 2014; Hopkins 1980; 2009). The "romanization", or shift from local cultural materials and practices to Roman ones, of the Pannonian region has not be explored to the same depth as

1 All maps created by Katherine Seufer using Google Maps, Quantum GIS, and Adobe Photoshop, unless otherwise noted. Citations from ancient texts refer to the following editions: *Appiani Historia Romana*, P. Viereck and A.G. Roos (eds) (Teubner, 1939; rev. E. Gabba, 1962), *Dio's Roman History*, E. Cary (ed. and tr.) (Loeb, 1914-27); *Res Gestae Divi Augusti*, P.A. Brunt and J.M. Moore (eds.) (1967); *Strabons Geographika*, S.L. Radt (ed. and tr.) (2002-3); and *Velleius Paterculus Historiarum libri duo*, W. S.Watt (ed.) (Teubner, 1988).

2 Sisak appears in App. 10.4.22 as *Segesta*; Strabo 4.6.10 and 7.5.2 as *Segestica*; and Cassius Dio 49.37.1 by *Siscia*. Appian and Strabo differentiate between the Roman fort *Siscia* and the Celtic oppidum *Segestica*. Also see Radman-Livaja 2007 for discussion of the naming conventions based on archaeological evidence.

Britain, Gaul, and other provinces (Woolf 1998; Curchin 2004; Oltean 2007).[3] Dendroarchaeology offers a direct look into this process, specifically the building of infrastructure related to Roman rule. In particular, in Siscia we are able to see the direct result of Roman interaction after the legal status of the city changed.

Archaeology has offered us a view of the historical chronology of Sisak, including large portions of the Roman period and parts of the Celtic pre-Roman occupation (Koščević & Makjanić 1995; Koščević 2013). The Roman city was built on the left bank of the Kupa, while the Celtic likely occupied the right bank, the peninsula known in Croatia as the Pogorelec (see Figure 2).[4] The period between Roman conquest in 35 BCE and before the granting of *colonia* status to Siscia in 71 CE is not well understood based on the existing archaeology, however, and only conjectures have been made about the possible situation for that century at Siscia.

A lot of archaeological material dates broadly to this poorly defined early Roman century. The causes for this chronological vagueness are several: poor archaeological contextual information and the nature of the material in question contribute significantly. Many metal military weapons from this era, the 1st century BCE to the 1st century CE, have been dredged from the river and, while lacking dated context, help to confirm what we know from the ancient literary sources about the importance of Siscia in Roman military actions in this period. Until

3 "Romanization" as a term is problematic at best (see, for example, Freeman 1996; Hingley 2005; Webster 1996 and the recent volume of *Archaeological Dialogues,* 2014 (1), but it is often used regardless due to its prevalence in the scholarship over the past few decades. I am using it in the course of this paper to describe the large-scale shift toward the use of Roman goods, building styles, and other practices, and my intention is not to imply ethnic or cultural identity of indigenous people based on the use of "Roman" material culture.

4 Excavations have not determined the exact location of Segestica. The ancient sources indicate that it was located on the small "peninsula" across the river from the Roman city, and limited work in the area confirms that this was likely the case. Furthermore, the cities may have existed simultaneously on opposing sides of the river for a period of time (Radman-Livaja 2007; Koščević 2013; Koščević & Makjanić 1995).

now, however, no buildings or other structural discoveries have been able to be attributed specifically to this early Roman period of occupation based on material finds alone (ceramics, metal finds), and our understanding of the actions of the Romans in this critical period have been severely limited. Wooden samples from beams and pilings from several years of excavation have been analyzed using dendrochronology and dated absolutely using radiocarbon wiggle-match dating, offering an incredible view of Roman urbanism in a newly conquered city during the period of colonization.

Figure 1. Location of Sisak on modern map of the Europe and the Mediterranean.

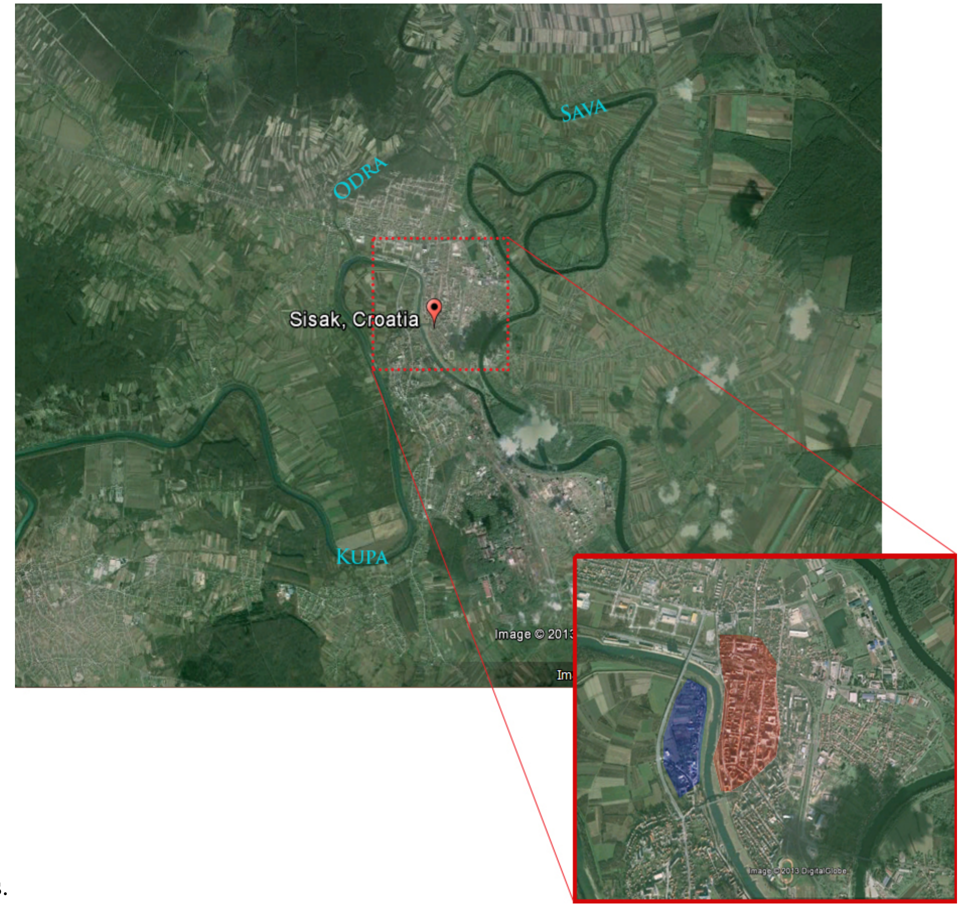


Figure 2. Sisak shown with location of Kupa, Sava, and Odra rivers. Inset, right: red highlighted area marks location of Roman city of Siscia, while the blue area marks the apparent location of the Celtic *oppidum* Segestica. Map modified with reference to Koščević & Makjanić 1995).

1.2 Ancient sources and the strategic location of Siscia

The strategic importance of the Savus valley and city of Siscia for the Romans cannot be understated. Rivers provided far quicker passage – and the key cargo transport routes – to Romans in contrast to much slower and less efficient land travel, and these river route ways formed valuable networks in the entirety of the Roman Empire (Adams 2012; cf. Greene 1986, pp.30–35 for archaeological evidence). This region offers easy access to Italy through the "Pear Tree" pass in the Alps, which has a summit height of about 884 meters (2,900 feet) which is the second lowest across the Alps, and the shortest distance across at 50 kilometers (30 miles) (Cary 1949, p.281). The Savus river formed the quickest passage from Italy into the increasingly important Danube frontier, and the two colonies of Siscia and Sirmium, which lay along this route, quickly gained military and economic importance (Mócsy 1974, pp.112–114). The expansion through this region was valuable to Octavian, and in the *Res Gestae*, he claims to have expanded the Roman boundary to the Danube through conquering the Pannonian peoples (*Res Gestae* 30), possibly meaning to its course near Sirmium (Šašel Kos 2010; Mócsy 1974, p.33).

In 35 BCE, Octavian advanced against the Iapodes in the course of his Illyrian War, continuing west until he reached Segestica (pre-Roman Siscia). The Celtic city was conquered by the Romans in 35/34 BCE, after two previous attempts in 181 and 119 BCE. Upon Roman arrival in the city, our sources explain that the local wealthy citizens heavily favored Roman rule and were willing to accept the harsh conditions of surrender; they would accept a Roman garrison and give them 100 children as hostages. The rest of the populace did not agree to the terms, and kept the elites from fulfilling the request, thus prompting Octavian to lay siege to the city. Octavian's assault lasted for thirty days before succeeding, and then he supposedly did not destroy the city, but instead allowed the local inhabitants to live separate from a garrison of twenty five cohorts which he left in the city (App. 10.4.22-4; Cass. Dio 49.36.1). Soon after Octavian's success, a brief uprising expelled the Romans from the city, but it was regained in short order (Appian 10.4.24; Cass. Dio 49.36.1; Mócsy 1974, p.22). From this point forward for the next few hundred years, Siscia was maintained by Rome, and held an important position in solidifying Roman expansion and later rule in the entire region.

Augustus used rivers as the boundaries of the northern frontier, and the connecting rivers to the frontier zone allowed for swift transport of goods, supplies and communication. The trans-Alpine provinces were not easily accessible from Italy, and in order to control this distant frontier, the lands holding the rivers linking these areas had to be controlled by Rome (Mócsy 1974, pp.34–5; Cary 1949, pp.281–6). The annexation of the Balkan territories in 29-28 BCE contributed to this need fully to control the Pannonian lands, though there seem to have been multiple revolts and the Roman hold on the area was precarious during this period (Šašel Kos 2011). Octavian (now Augustus) sent the trusted, experienced military leader M. Vipsanius Agrippa to handle the situation in 13 BCE (Cass. Dio 54.28; Šašel Kos 2011; Mócsy 1974, pp.34–5). Agrippa died shortly after arriving in 12 BCE, and Roman expansion to the Danube through the Save valley was completed by Tiberius (Cass. Dio 54.28-31; *Res Gestae* 30). Most of Pannonia was likely conquered during this war, though literary evidence is relatively sparse, and wanting for many details (Šašel Kos 2011; Mócsy 1974, pp.34–6).

The Save valley (including the cities Siscia and Sirmium) played a critical role for

Augustus and Tiberius during the expansion of the empire and the associated wars. Due to its location linked directly to Nauportus and further back to Italy, Tiberius used Siscia as a base for his operations in the region in 11-9 BCE, and again during the Pannonian Revolt of 6-9 CE after it proved useful in the previous engagement (Mócsy 1974, pp.37–8; Radman-Livaja & Dizdar 2010). The Pannonian Revolt of 6-9 CE was undoubtedly extremely large and posed a critical threat to Roman interests in the area and possibly even Italy. Velleius Paterculus, who fought in Pannonia, and Cassius Dio both discuss this revolt, though much detail in certain aspects is lacking (Mócsy 1974, pp.38–9). Velleius Paterculus cites some 200,000 combatants out of 800,000 insurgent peoples (Vell. Pat. 2.110.3), though based on population estimates, the reality had to be far fewer, likely around 85,000.[5] 10 legions, 70 auxiliary cohorts, 14 cavalry units, 10,000 veterans and some volunteers were allegedly stationed with Tiberius in Siscia for use in the revolt, confirming the importance of the region for Roman interests (Dzino 2006; Vell. Pat. 2.113.1-2).[6]

After the rebellion was thwarted, the area was established as a province, and Illyricum was divided into Dalmatia to the south and coast and Pannonia to the north (Mócsy 1974, p.39). The success of Tiberius in these battles and the preservation and extension of Roman power in this region ensured the separation of various Celtic groups in Dalmatia and Pannonia, and aided in preventing further uprisings in future years (Cary 1949, p.283). Siscia became officially

5 For a detailed discussion of the population of Pannonia, mobilization rates, and other literary sources, see Dzino 2006. Vast quantities of Roman military equipment have been found in Siscia (some of the largest collections of certain types) and in the surrounding areas. For an overview of material that can be likely dated to the Pannonian Revolt, and discussion of other potential military camps in the region, see Radman-Livaja & Dizdar 2010.

6 Though two legions left soon after their arrival in Siscia, this still leaves a huge number of troops stationed in Siscia under Tiberius (Vell. Pat. 2.113.2).

recognized as a colony as *Colonia Flavia Siscia* during Vespasian's reign, likely in c. 71 CE, and likely saw a large influx of soldiers to the newly formed colony.[7] Additional evidence for this period of the first century CE based on names in inscriptions and from lead tesserae (originally mostly from textile sales) indicate a very heterogeneous population at Siscia containing military veterans, merchants, and other people from the greater Illyrio-Pannonian region, as well as people from northern Italy, Dalmatia, Gaul, and Hispania (Radman-Livaja & Ivezić 2012). After its use in the Pannonian War and the Great Pannonian Revolt, Siscia gained in size, status, and recognition during the Empire. A couple of centuries later, under Septmius Severus, Siscia gained an additional title as *Colonia Flavia Septimia*, and throughout the third and fourth centuries CE, it was the site of an imperial mint (Burian 2006).

7 We can date this event to the Flavians based on the title Colonia Flavia Siscia, and tighter chronologically to Vespasian through Pliny, *NH* 3.147, and through military discharge diplomas, CIL 16.14, 18 (Fitz 1980, pp.142–3; Šašel Kos 2010; Watkins 1983).

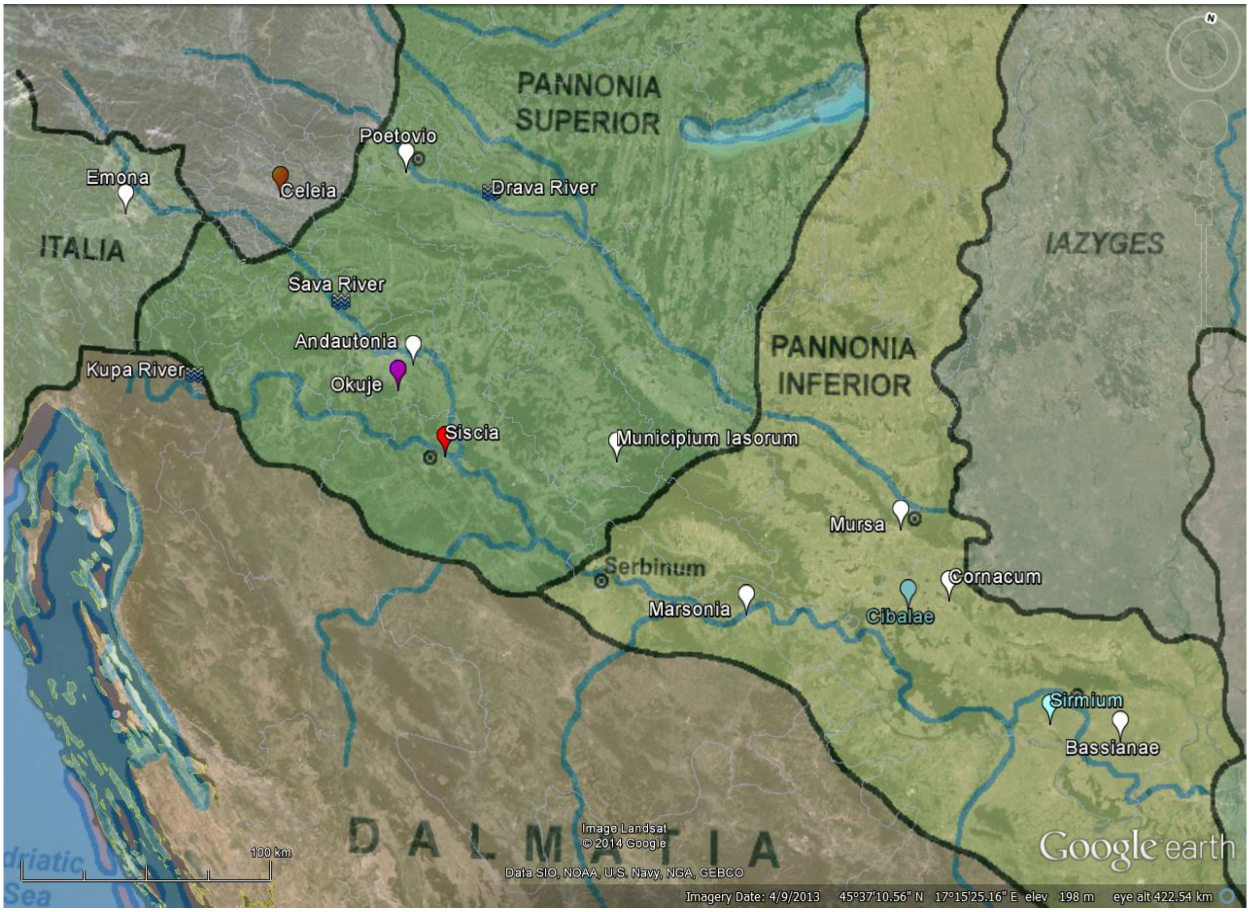


Figure 3. Siscia (red), in relation to other important cities in Pannonia and the Save river valley.

1.3 Archaeology in modern Sisak

Archaeological efforts in Sisak are severely hampered by the modern city's location directly above the Roman city. The city has maintained some of the aspects of the ancient city, including some of the road network and the general shape of the Roman city walls (See Figures 2 and 6). Excavations in the 19th century led to maps of the ancient city walls and some other large structures such as one of the bath complexes. Other structures that were visible and have since been confirmed through modern archaeology include some of the city roads and the forum. The main north-south cardo maximus of Siscia, made of stone and 7-9 meters wide, was likely put into place during the Flavian period, after the granting of *colonia* status in 71 CE (Lolić & Weiwegh 2012, p.197; Lolić 2006). The decumanus maximus was positioned to the north portion of the town, and the recently confirmed forum was located at the intersection of the two roads. Some of the public architecture, including the Forum and northern gate, likely date to the second half of the 1st century CE, but excavations and research are ongoing in this area (Lolić 2006, pers. comm. 2014).

Most of the modern archaeological projects in Sisak occur when new building projects are undertaken and rescue archaeology is necessary. Due to the invasive nature of archaeology, it is difficult to get permissions to investigate many areas of the ancient city today. Substantial amounts of iron materials, however, including immense amounts and variety of military equipment, have been discovered in the river Kupa and new finds are found frequently. Considering the city's importance in the Roman period and the large size that it attained, there are unfortunately relatively very few extant inscriptions to aide our interpretations (Koščević & Makjanić 1995, pp.13–14). It is likely that many inscriptions have been lost due to reuse of building materials in modern infrastructure (Marina Bradač, pers. comm. 2014).

Thousands of inscribed lead tesserae, which were tied to purchased textiles in antiquity, have been found in the river Kupa and in a pit dating to the first century BCE or first century CE just inside the northern gate complex (Radman-Livaja 2010).[8] These tags include information such as price, item, and name of individual who purchased the textiles, showing both information

8 Most of the tags date from the mid-first century BCE to the late first century CE or early second century CE, though some date to later.

about personal identity and economic activity. The names depict a very interesting portrait of the population living in Siscia and participating in likely "regular", commonplace trade activities: 40 percent of the names are female, 54 percent are Latin, 20 percent are likely Celtic, 7 percent are Illyrian-Pannonian, 6.5 percent are Greek, and the rest are from other origins or uncertain (Radman-Livaja 2010; Radman-Livaja & Ivezić 2012). 76 percent of the names contained in the tags were partially Latin, however, showing that even the non-elite population in Siscia was absorbing Roman/Latin onomastic traditions in this period soon after conquest. Almost none of the names on monumental inscriptions point toward Illyrian-Pannonian naming traditions, but instead primarily Latin (and some Celtic), and indicate a wider use of Latin naming traditions among local elites (Radman-Livaja & Ivezić 2012).[9]

The textile industry was likely one of the largest in the Roman economy, and permeated all levels of society (Erdkamp 2012, pp.248–9), which further confirms that this image is likely relevant for most of the population. As the majority of the tags have been found in the Kupa, the textiles may have been produced in Siscia and the tags simply discarded in the water, or more likely, they were transported to Siscia using the river.[10] Based on the information written on the tags, such as names and professions, it seems that the materials (including clothing, fabric, and other such items) were likely transported to Siscia as an end destination in some cases (to the

9 While Latin naming traditions appear to be more prevalent in the elite, we have to be careful reaching conclusions about ehtnicity based upon naming traditions. See Broux 2014 for discussion of "double naming" in the context of social stratification in Roman Egypt.

10 See Radman-Livaja 2010, pp.517–31 for a more in depth analysis over whether the textiles were likely produced in Siscia or in other locations and transported there either as a final destination or as a place for further working of the material. See Wild 1970 for more information on the textile manufacturing process in the Roman world. It appears that these were being transported to the end user, as the names are sometimes accompanied with the receiver's profession (which are not clothing-related). This does not imply that this was always the case, however, and more evidence is needed for this to be certain.

consumer) and in others, for further processing by fullers and dyers (Radman-Livaja 2010, pp.517–9).

1.4 Samples collected for dendrochronological purposes

Samples were collected by the Malcolm and Carolyn Wiener Laboratory for Aegean and Near Eastern Dendrochronology at Cornell University over a multi-decade period with the aid of Professor Aleksandar Durman (University of Zagreb) starting in the 1980s. Most of this work was done by the ongoing Aegean Dendrochronology Project (ADP), which aims to construct an absolute tree-ring chronology for the eastern Mediterranean region through archaeological, historical, and forest tree-ring samples (e.g. Pearson et al. 2012; Griggs et al. 2007; 2009; Kuniholm & Striker 1987). Modern dredging of the Kupa river brought many wooden beams into visibility, and many of the samples come from such dredging in different locations on the Kupa. Other samples were selected from excavations at various locations on the site, during regular and rescue excavations, as well as sampling from the river area when the water level is low enough to access them (Images 1 and 2). The river harbor and relatively wet conditions at the site has preserved most samples in excellent condition.

The Roman samples are all *Quercus* spp., which provides excellent potential for cross-dating (Haneca et al. 2009). Unfortunately, however, no continuous, absolute chronology has yet been constructed in the region reaching into this Roman period. In these situations a dendrochronological date cannot be obtained, as there is no absolute "master" sequence with which to obtain a crossdate. In a case like this, other methods must be employed in order to obtain a precise and accurate date for the samples collected and their constructed relative chronology. Most of the dating for the sample locations has been based on thousands of coins, inscribed lead tags, ceramics, and other material, but these have not provided very precise dates thus far; often only to the century, or at best, half-century (Radman-Livaja 2010; Koščević 2013; Koščević & Makjanić 1995).

Figures 4 and 5. Pilings in the river Kupa pre-sampling. (Photos courtesy of P.I. Kuniholm).

Single ^{14}C dates have been used liberally at the site, but often have such a large error margin that the resultant dates are not as precise as the other methods listed above. Therefore, in this case, I have employed radiocarbon wiggle-match dating in order to obtain absolute dates for this chronology and samples, and thus, various structures on the site.[11] The chronology from Sisak spans 363 years and includes samples from a variety of contexts, helping us to better understand multiple excavated areas at Sisak, and Roman activity at the site in general, and give more precise dates to these excavations.

11 Work is ongoing in the region to gather enough data for better results in this period, for example, see (Ważny et al. 2014)

2. Methods

2.1 Tree-ring analysis

Dendrochronology (tree-ring dating) at its best can provide the felling date for the tree used in construction, and thus a very precise terminus post quem for the placement of the beam and other material in the archaeological context. Through measurement of the annual growth information for each ring across a sample, a graph of the ring patterns is created and matched against other regional data. Each radius is first measured individually on the sample, and the resulting data is summed together to create a master measurement for the individual sample. Multiple samples from the same tree or beam are summed to create a data set which represents the unique pattern indicating climate and local growing conditions for that specific tree. The measurement patterns are then cross-matched relative to one another from the same site, using visual and statistical methods in the measurement programs. The samples then can be summed into a "master" chronology for the site, which contains information relevant for a larger climate area than the individual samples.

Figures 6 and 7. Scanned image of beam (*left*) showing some remaining sapwood on far right edge (lighter colored portion near the end of shrunken portion), and 6x microscopic image of oak sample at Sisak (*right*). Note the typical "flame-like" patterning of the latewood, characteristic of *Quercus* sect. *Quercus*.

162 samples from beams which appeared to have more than 40 rings, sapwood, or complete outer rings were sectioned on-site for analysis.[12] The samples were covered in plastic wrap or placed in bags to be kept moist, and then sent back to the Cornell tree-ring lab. Since their collection and initial analysis, they have been kept in a cool, dark environment in storage at Cornell University. Wet samples were prepared using double-edged razor blades and drier samples with sanders, and multiple radii (normally two) were measured using a microscope, measuring platform, and dendrochronological analysis packages CORINA (Brewer et al. 2010) and Tellervo (http://www.tellervo.org). Using said programs, metadata were recorded for each sample including species, pith, sapwood (the outer set of rings), waney-edge (the final ring), and bark information. The resulting sum was checked using COFECHA 6.02 (Holmes 1983). The samples from Roman areas of Sisak were cross-matched with one another using the Student's *t*-test and visual comparison (Baillie & Pilcher 1973; Pilcher 1989).

2.2 Radiocarbon wiggle-match dating

As discussed briefly above, a single radiocarbon result often does not return the precise results necessary in order to study wooden material from archaeological contexts. In this case, radiocarbon wiggle-match dating can provide the definition desired by combining radiocarbon data with relative tree-ring information within a Bayesian model (Bronk Ramsey 2009; Bayliss 2007). In order to arrive at these results using a Bayesian chronological model, we gather tree-ring data such as sapwood presence or bark edge, alongside a series of radiocarbon dates from the chronology for the analysis (Galimberti et al. 2004; Bayliss & Tyers 2004).

12 At present, of these samples, 115 were usable for dendrochronology based on ring count and condition, and four chronologies were created. They date from the 9th c. BCE through the Roman period. The Roman chronology is the longest and the most robust. None of the chronologies have external cross-dates which are absolutely dated as of 2014 (special thanks to Dr. Willy Tegel, University of Freiburg, for helping to confirm this situation).

For this chronology, thirteen radiocarbon dates were originally run at the radiocarbon lab in Heidelberg, Germany. Unfortunately, half of the dates returned as "outliers", that is, the returned radiocarbon date did not match on the expected wiggle-match placement based on the dendrochronological evidence and using Bayesian modeling. This may have happened due to a variety of problems; the radiocarbon results could have been incorrect, the samples may have been contaminated (pre- or post deposition), the dendrochronological sequence may have been incorrect, or the samples may have simply been mislabeled prior to sending them to the radiocarbon lab. Given the usual record of accuracy and precision at the Heidelberg laboratory over the relevant period (e.g. Manning et al. 2010), one of the latter possibilities seems most likely to be the problem. The large number of outliers made it difficult to achieve the desired precision that is possible when wiggle-matching samples with final ring information and with so many dates processed.

In this case, it was not possible to resolve the original problem (samples are destroyed in the radiocarbon dating process), so I selected a new set of six radiocarbon dates from a different set of samples in order to avoid potential problems due to an incorrect dendro match or sample-specific problem. I dissected six sets of ten-year segments of rings chosen from three separate samples in the chronology, spaced 25-60 years apart, avoiding areas of the chronology with low correlation among samples and periods that had been dated previously. The three samples that I dissected had high visual and statistical matches with the rest of the chronology, which minimized the likelihood of error. The samples from Sisak were then sent to the Vienna Environmental Research Accelerator (VERA), and wiggle-matched using Oxcal v. 4.2 (Bronk

Ramsey 1995, 2009; Bronk Ramsey et al. 2001; Galimberti et al. 2004) against the IntCal13 radiocarbon calibration curve (Reimer et al. 2013).

3. Results

3.1 Dendrochronological results

Of the 162 samples, 115 contained enough rings (more than 50) to be measured and potentially dated, and 34 cross-match to create the Roman chronology for Siscia.[13] They come from mostly known Roman contexts and locations in the river where large numbers of Roman finds were discovered. Some samples are from areas where the period of occupation is uncertain and the material remains are both Celtic and Roman in style. Unfortunately, we lack detailed sample provenience information for many samples due to the circumstances under which many of the samples were excavated (river dredging, etc),[14] but at least general areas and structural information are known for most, and some detailed information is known for more recently excavated samples. Almost all of the samples from Sisak are *Quercus* (oak), specifically *Quercus* section *Quercus* (white oak), based on the flame-like patterning of the latewood (see Figure 7). These oaks are typically very useful for dendrochronology and radiocarbon dating, in that they have an estimable average number of sapwood rings based on the age of the tree, thus giving a very precise cutting year for the tree, even in cases where the last ring (waney-edge) or bark are not present (Haneca et al. 2009; Griggs et al. 2007; Griggs et al. 2009). Many samples contained sapwood and some had waney-edge, providing the ideal dating situation for the site and a stronger radiocarbon wiggle-match date (Bronk Ramsey 2009; Bayliss 2007).

13 Other samples were matched to create three other chronologies, and those date from the Hallstatt period to the Celtic period, based on radiocarbon dating.

14 Some samples were taken while dredging – meaning that the archaeological team was brought in for rescue excavation and were not able to fully excavate the area.

External cross-dating was successful with nearby and similarly undated sites, but no external dates were possible with large, absolutely dated chronologies from other areas in Europe. The chronologies from trees from Germany (obtained from the International Tree Ring Database) do not cross-date against the Sisak data with any certainty, nor do any internal data sets from Italy or the Aegean, nor any of the major unpublished European chronologies. This is not surprising, given our understanding of the variety and complexity of climate conditions in the Mediterranean (Horden & Purcell 2000). The nearby site of Celje (Celeia) has been dated against the Sisak Roman material in the past (Durman et al. 2009), and it also definitely matches against the "new" Roman chronology that I have developed and re-dated using radiocarbon. Samples from the nearby archaeological excavation in Okuje, which lay along the road from Andautonia to Sisak, also definitively match against the Sisak chronology.[15] The close correlation of the data from these areas implies that there is a regional oak climate signal that is separate from the trees growing north of the Alps (the German data) and from the trees growing further east (Durman et al. 2009).

	Okuje Wells (49-205CE)	Celje 801 (105-233CE)
Sisak Roman (159BCE–204CE)	**8.17**	**4.92**
Celje 801 (105-233CE)	2.28	-

Figure 8. T-Scores for external cross-matches between Sisak and nearby sites. Also see Figure 10 for a graph of the cross-matches and Figure 3 for a map, with sites highlighted).

15 Data from these chronologies are internal and unpublished.

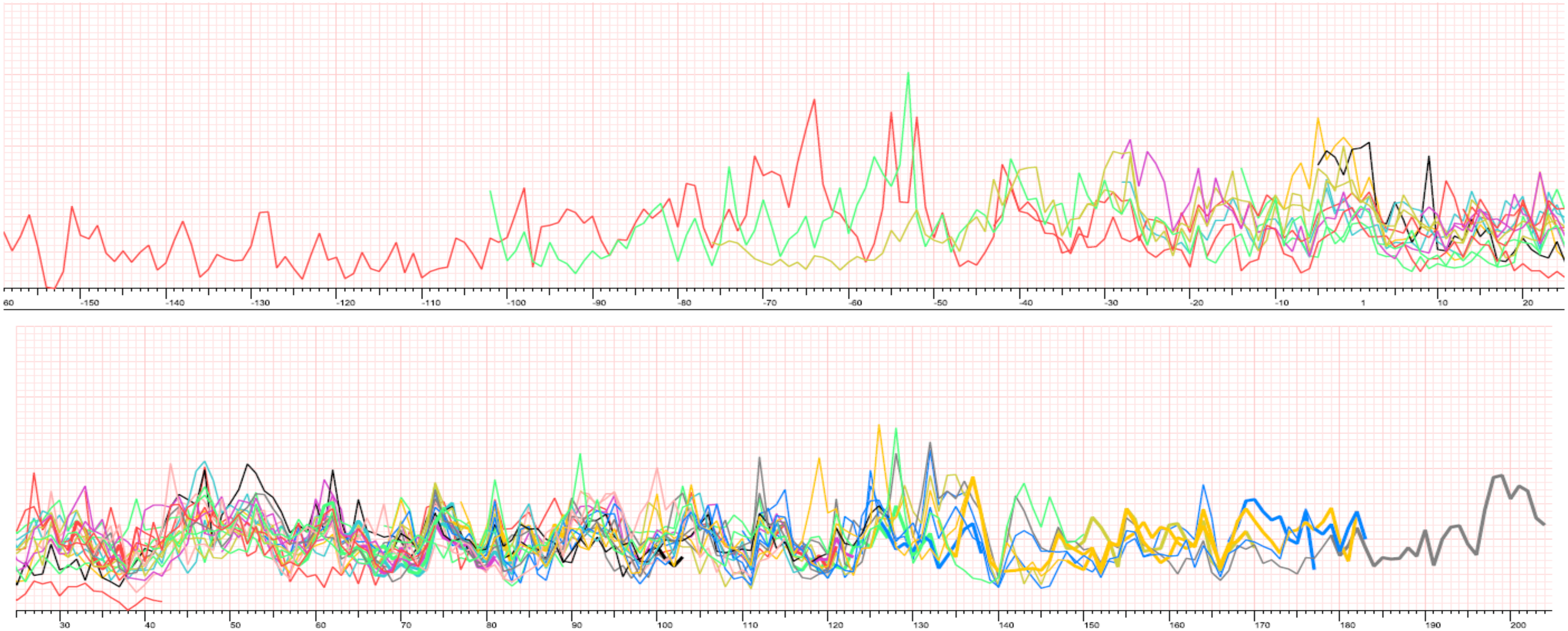


Figure 9. Graph showing all samples in Sisak Roman chronology (wrapped from top to bottom). The sample depth from ~10 BCE to ~145 CE is best, while the data is lacking toward the beginning of the chronology.

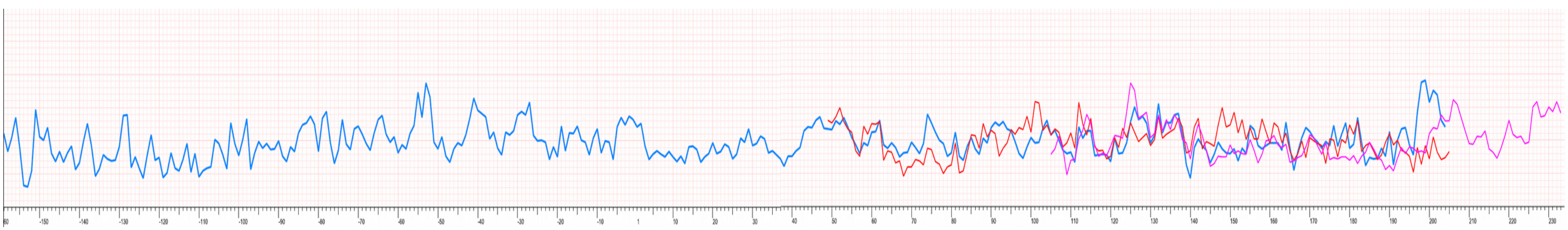


Figure 10. Graph showing Sisak (blue) against Roman wells at Okuje (red) and Roman bridge at Celeia/Celje (purple).

3.2 New wooden samples from Siscia

New samples (October 2014) were collected from underneath the second and third century Forum at Sisak (see Figure 11 below for locations of all collected samples). These samples were from what appeared to the excavators to be the early Roman occupation of Sisak, and a mixed context of Celtic and first century BCE Roman material was discovered in the layer from which the beams were recovered.[16] One of the samples has a potential match against a sample from the nearby Andautonia (modern Šćitarjevo, Croatia) which was founded as a colonia in the first century CE and lay along the road from Poetovio to Siscia (see Figure 3 above for map of the region). The most likely date, which is based on statistical cross-dating, visual match, and historical and archaeological interpretation, is at 31 BCE (+/- 11), which would indicate that the central area that later became a monumental forum in later centuries, was likely used in the early Roman occupation period, shortly after conquest in 35 BCE and well before colonia status in 71 CE.

The other archaeological evidence in this portion of the site shows mostly Roman material dating to the first century BCE and first century CE, but there is also some included Celtic material from roughly the same period. It appears that the buildings were Roman, and built after they conquered Segestica/Siscia, and that this portion of the Sisak was not used before Roman occupation, but it is not currently clear based only upon the excavations.

Unfortunately, the Roman chronology for Sisak is weakest in this period, with only one sample covering the first 57 years of the chronology from 160 to 103 BCE, two from 102 to 77

16 The material discovered in this layer is mixed and we cannot no for certain who the occupants were. There are large amounts of Roman-style objects that could have been imported to the region prior to Roman rule (ceramics, Roman-style fibulae), as well as some Roman military material, as well as items showing traditionally Celtic iconography.

BCE, and so on (see Figure 9 above to see the low sample depth for this period). This period of the chronology also has low correlation among currently included samples, but due to sample preservation since collection in the 1980's, they cannot be remeasured and checked. This period of occupation at Sisak will only be thoroughly resolved through the collection of new samples from Sisak or from the surrounding region for the first century BCE. Based on archaeological and historical evidence from Sisak, it is clear that the Romans occupied the city in the period between conquest and colonization (discussed in depth above), but no excavated buildings have been so far attributed directly to this period.

Figure 11. Map of excavated areas at Sisak. Shaded areas outside of city represent burial areas, dark blue lines inside represent known or excavated roads, solid orange lines on the outside represent excavated/located or projected outlines of city walls. Other figures represent excavations at Sisak. The stars represent areas where wooden samples have been excavated – the red star is the area of the Roman aqueduct, green is the mint/workshop area and river fortification beams, blue is the area of in situ posts and beams from the river harbor, purple is the eastern defensive wall and associated houses, orange is the newly excavated forum (2014), and teal is the northern gate complex and settlement houses.[17]

17 Map of cumulative excavations courtesy of Tanja Lolić, based on her unpublished dissertation (2014).

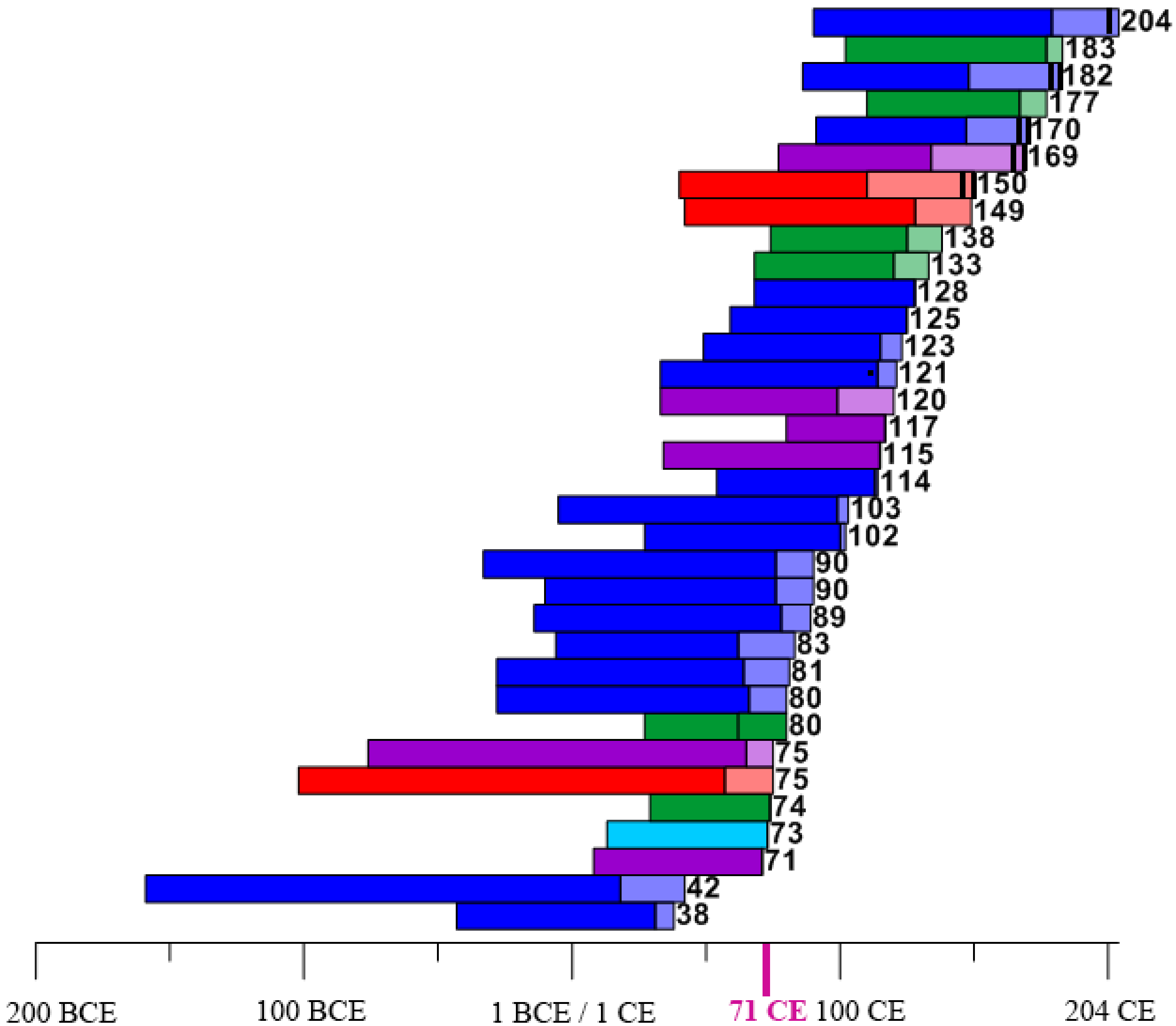


Figure 12. Bar graph of samples included in Roman Sisak chronology. Colors indicate areas of the site where samples were taken, and correspond to Figure 11 (above). 71 CE (*colonia* status) marked in magenta at the bottom of the time scale (x-axis) for reference. Lighter portion of bar indicates sapwood presence. Double line at end of bar represents certain waney-edge (last ring), though others likely also are very close to the last ring.

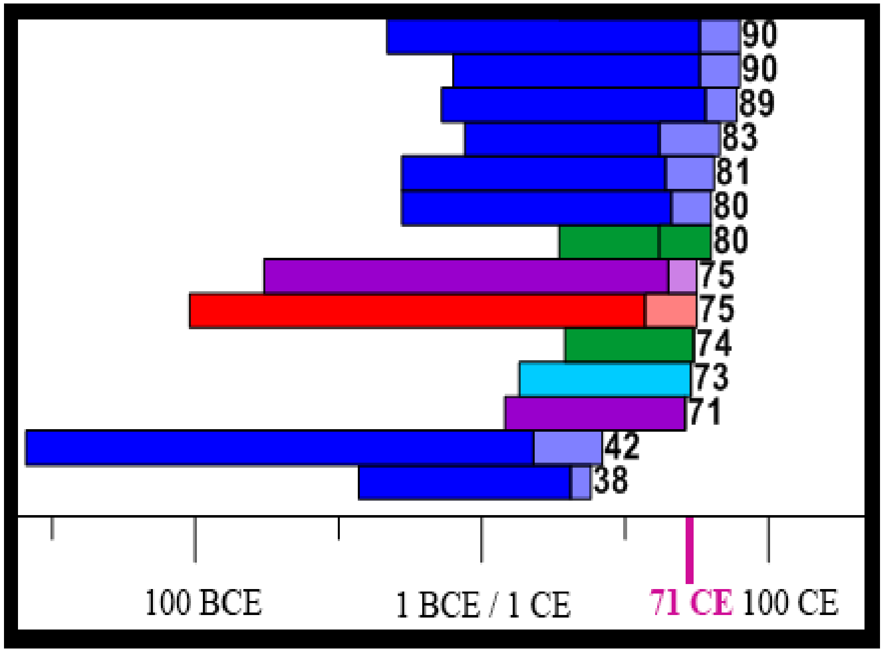
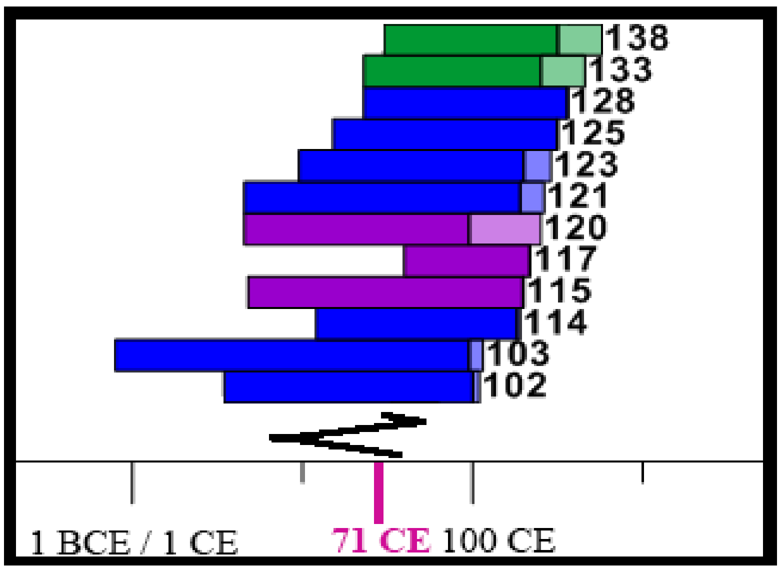
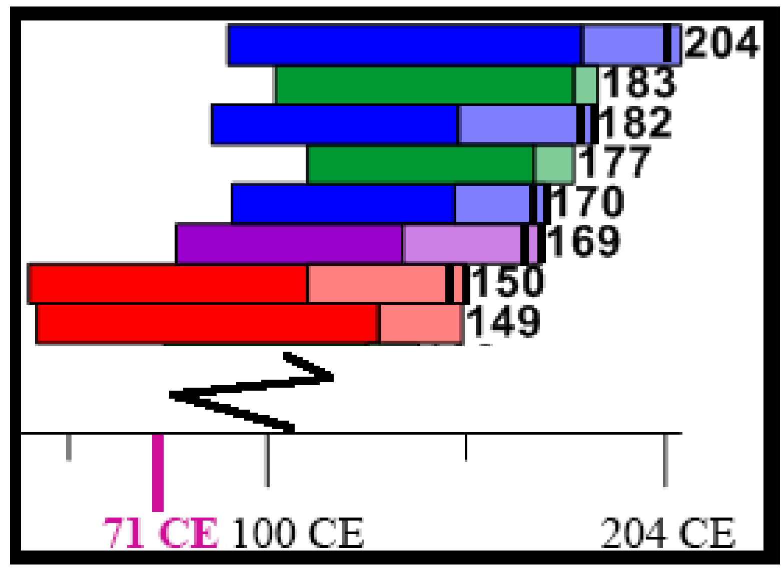


Figure 13 (*left*)**.** Detail of Figure 12: group of samples directly following 71 CE event; "Phase I" of building activity.

Figure 14 (*below left*). Detail of Figure 12: second group of samples; "Phase II" of building activity.

Figure 15 (*below right*). Detail of Figure 12: third group of samples; "Phase III" of building activity.





3.3 Radiocarbon wiggle-match results

Reassessment of the original placement of the chronology was necessary, as the original radiocarbon samples from this chronology were problematic and more than half of them were outliers when the data set was wiggle-matched. These issues could not be resolved, and six radiocarbon dates were selected and sent to the Vienna Environmental Research Accelerator (VERA) for radiocarbon dating analysis. Some of the original dates were retained in the wiggle-match, but the potentially contaminated or otherwise problematic samples were removed. The new results place the chronology in an earlier period than initially believed, and with a smaller margin of error.

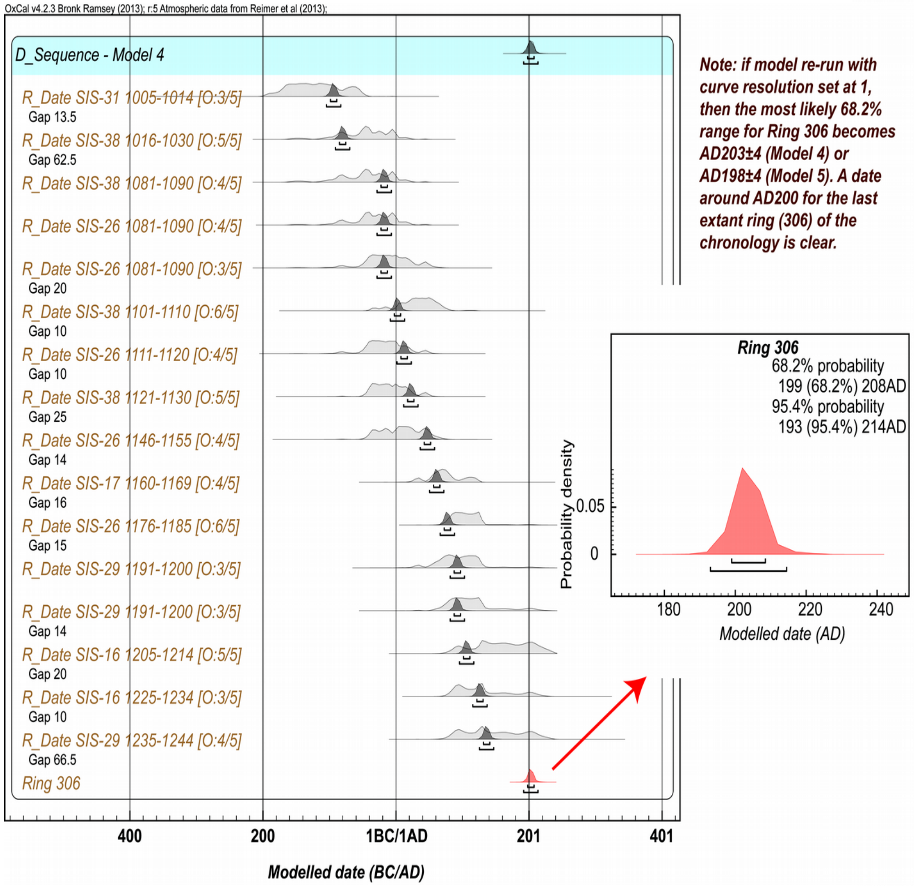
The radiocarbon wiggle-match from Sisak based on six new dates and some of the previously analyzed samples indicates an earlier date of 204 +/- 11 CE for the last ring of the chronology. The last ring of the chronology is also waney-edge, meaning the last ring is present, which directly represents the felling year of the tree. The previous radiocarbon results for samples at Sisak placed the chronology at 260 +/-17 CE, meaning the associated contexts date to decidedly earlier periods. Figures 16 and 17, below, show models of the radiocarbon dates, wiggle-matched against the IntCal13 curve.[18] Multiple outliers were removed progressively (Figure 16), and the final ring date, with the outliers removed, falls between 199-208 CE at 68.2% probability, or 193-214 at 95.4% probability (Figure 16).

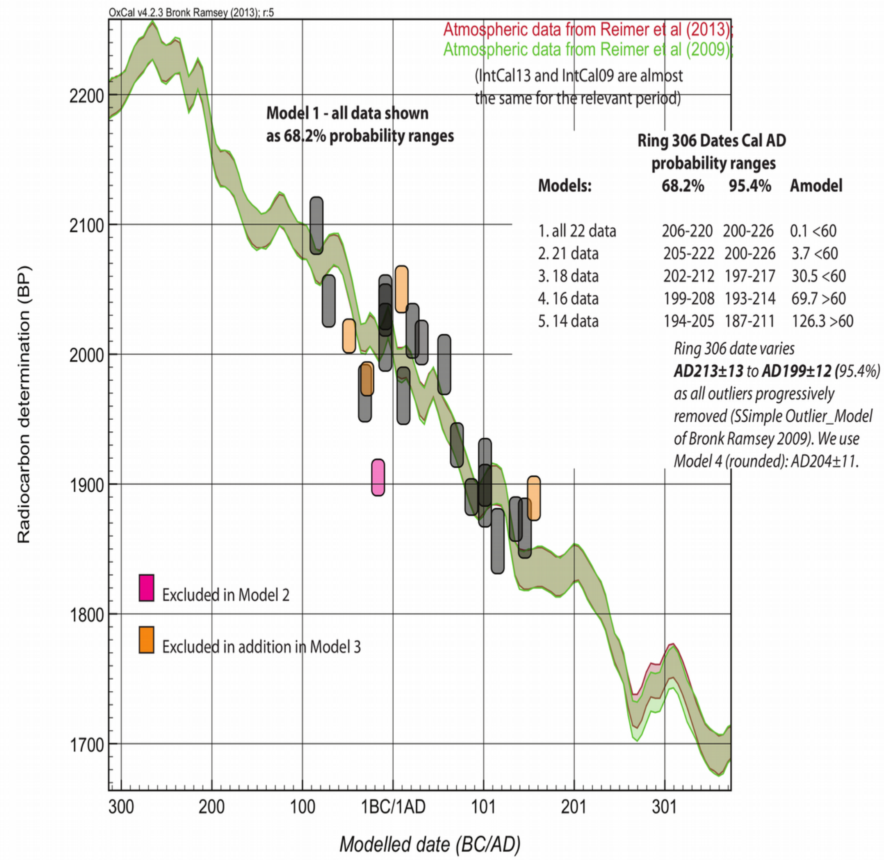
This chronology covers an important period of expansion and change in the Roman Empire. Climate models are now being used to study this period of Roman expansion and later

18 IntCal09 and IntCal13 curves nearly identical in this period, and use of either does not change the results (Reimer et al. 2009; Reimer et al. 2013).

“fall”; with currently very little dendrochronological evidence in this region, this chronology may offer a new perspective. This data set combined with current and future nearby chronologies will give us a view of the regional climate signal and a more sophisticated understanding of this prosperous period in the west.[19]

19 See McCormick et al. 2012 and Harris 2013 for the current debate on climate change in the Roman period.





Figures 16 and 17. Models created in OxCal 4.2 showing the wiggle-match of the ^{14}C dates analyzed from the chronology. Figure 17 (*right*) shows clearly the outliers when the samples are placed against the radiocarbon curve (colored in purple and orange). Removing the outliers returns the date of 204 +/- 11 CE for the last ring in the sequence. Models created in collaboration with Sturt W. Manning (Cornell University).

4. Interpretation and Conclusion

The chronology of oak timbers from Siscia offer a rare glimpse into the chronology of urbanism in an important Roman city in early Pannonia. After the granting of *colonia* status in 71 CE, Siscia quickly gained multiple buildings and structures; a workshop and river bank support, a river harbor, an aqueduct, defensive wall, and various house structures. The status shift appears to have had a critical impact on the city; the Romans had conquered the Celtic oppidum a century earlier, and it had served an incredibly important role in military operations in the meantime, and yet most major building operations appear to have commenced only after this political change.[20] Based on current archaeological evidence and interpretation, these buildings were new and not being "rebuilt" with new specifications (T. Lolić, pers. Comm. 2014).[21] Riverine building active appears to have continued almost constantly after this period, either as expansion or repair was needed, though the aqueduct in Siscia was built very soon after *colonia* status, and the felling year dates to 79 CE (+/- 11) with at most a couple of rings missing.[22] In the first and second centuries CE, Siscia had a grid road network (see Figure 11), and held multiple bath complexes (one private and at least one public), along with a central forum,[23] a first century

20 The amount of time to officially form a colony after conquest is considered normal, see Šašel 1980 about the "three generation rule".

21 The forum (see section 3.2) appears to have some of the earliest building structures in place. The buildings dated without dendrochronology (using pottery, inscriptions, and other evidence) are not dated in a narrow enough range to know specifically when in the first century they were built, though some date to much later, such as a third century villa, for example. Some of these later buildings may have been built on older structures, but again, archaeological recording and data is lacking in many instances.

22 Based on sapwood estimations for nearby regions in Haneca et al. 2009, and the 17 sapwood rings present on the sample.

23 Perhaps two forums – one large one (located on Figure 11 with orange star) and possibly one smaller one toward the southern end of the city, though the excavations were not entirely conclusive (T. Lolić, pers. comm. 2014).

CE northern gate complex,[24] multiple houses, and defensive walls.[25]

In addition to the buildings dated to this period of the first century CE, there is also vast amount of other archaeological evidence from Siscia to supplement our understanding of the social, economic, and military situation in the city for the period in general. A large number of metal goods were produced in the area surrounding Siscia, military items and many other uses, from the iron located in the nearby hills and to the south (Durman 1992). Archaeologists have found over a million tons of Roman slag and associated workshops, which date from the first century CE in the region. Evidence suggests that the Romans refined the metal into ingots outside of the city, and then shipped the ingots to Siscia, where they were further processed into military gear, adornment and decorations, vessels, writing equipment, figurines, and craft objects (Koščević 1995; 2002; 2013). This period in Siscia is also marked by a sharp peak in the number of pottery imports from Italy and Gaul (Makjanić 1995). The lead tesserae (described in section 1.3, above) illustrate a complex, heterogeneous image of the population of Siscia in this period, with military veterans and civilians originating locally as well as from the larger region and Gaul, Italy, and the east. The tags also indicate a vast amount of textile trading occurring in the city.[26]

The urban city played an essential role in the Roman Empire, and Siscia was no

24 Excavations on going for archaeological park (Lolić 2006). Wood from this site has not yet been analyzed due to extensive flooding this year.

25 There was also likely a wooden amphitheater built in this period, though it has not been uncovered in excavations. Inscriptions and other material remains point to its existence in this period, and a potential location could have been on the pogorelec. See Vukelić & Pernjak 2012 for more on the evidence and potential location.

26 Hundreds of new lead tesserae (appear to have similar names and textile information, but not fully analyzed) have been found in a heap in new excavations of the northern gate complex (see teal star, Figure 11). It is unclear from where the original textiles would have originated – the textile trade was vast and the tags do not indicate their origin. Their quantity (thousands) and discovery in the Kupa river and at the northern gate show that extensive trade was occurring at these places in the city.

exception. Roman conquest brought with it the placement of new cities in a region, or the further development of existing indigenous centers. The "city" was not merely a population living in one place together; it was the center for political, economic, and social activity in a region, and specific urban structures can be identified throughout the Roman Empire by characteristic attributes, whether the city lay in North Africa or in Italy (Edmondson 2007; Laurence et al. 2011; Woolf 1998). The process of urbanization was vital to integrating new regions into the empire, however it was not uniform through time or space, and individual studies for specific regions are necessary for a more robust understanding of this development (Millett 1990; Woolf 1998).

After a period of disruption in a newly conquered region, Roman occupation and administration over the area increased production and trade through urban centers (Hopkins 1980). The long term effects of this process in a region is debated, though the occupation and management was certainly necessary to facilitate an empire that covered most of the Mediterranean region (Garnsey & Saller 2014, pp.109–27; Erdkamp 2012; Roselaar 2012). In the Roman Republic, the *colonia* was an extension of Rome, filled with Roman citizens and veterans and a standard constitution with the same legal mechanisms as Rome (Garnsey & Saller 2014, p.41; Laurence et al. 2011, pp.55–58), though the physical layout of these cities likely varied more than we have traditionally believed (Mauritsen 2004).

Many studies of the Imperial period interpret the title of *colonia* as honorific in many ways rather than meaningful in many of its effects (Garnsey & Saller 2014, p.41), though it still granted citizenship (Millar 1977, pp.394–410). This granting of citizenship benefited the local elite to a greater extent than others; the legal privileges of social status, developed property rights, and other entitlements served to reinforce their authority and power in a region (Curchin 2014, pp. 48-51; Garnsey & Saller 2014, p.134; Woolf 1998, pp. 18-19). For a city to become a *colonia*, the inhabitants of the city would have aspired to achieve greater recognition in the empire, and the emperor in turn could grant the status as a gift or *beneficium* to the city (Laurence et al. 2011, pp.66–68).

Based upon the material evidence and dendrochronological results, the late first century BCE and first century CE both formed significant periods of growth for Siscia; the population was diverse,[27] and increasingly adopted Roman goods and customs,[28] and the architecture and infrastructure were rapidly developing. The street grid network present in Siscia was an important feature to Roman colonies in Italy and Gaul, along with other typically "Roman" buildings and city planning; the forum and nearby temples, location of burials outside of city walls, zoning of building areas, and houses also show such Roman characteristics (Woolf 1998). The archaeology that has been done in Sisak seems to conform to this traditional model and had to have been instituted at a relatively rapid pace; the wooden beams that have been dated, in conjunction with the other archaeological evidence, point to the grid network and general layout already being in place in the mid to late first century CE.

27 The majority of the lead tags date to the this period of change in the city, though some certainly dated to later (e.g. second and third centuries CE, dated with paleography). The majority of the inscriptional evidence points to the earlier period discussed for most of the tags. Even without the lead tags we can generally assume a mixed population of Romans (mixed group of soldiers) and local inhabitants of various ethnic identites, as it was rare for the Romans to completely annihilate a group upon conquest. From the ancient sources (discussed above) we can understand the existing Celtic population as already socially stratified pre-Roman conquest, however, archaeological evidence has yet to confirm or deny any in-depth understanding of pre-Roman Siscia.

28 There appears to be a continued worship of "Celtic" gods, though after the first century we see more and more iconography relating to more traditionally "Roman" gods. Roman housing styles appear to be increasingly adopted, though there have not been enough excavations in the city to confirm other styles. A first century bath complex has been found, though most date to the second and third centuries.

Creating this typically Roman or Italic structured city with Roman houses, street networks, and forum, served the expansive military and economic needs of Rome in the middle of newly conquered Pannonia. The citizens themselves desired to increase their position in the Roman empire through gaining *colonia* status, an aspiration likely felt most strongly by the wealthy elite. Siscia shows all of the characteristics that define those needs and desires. Veterans were placed in Siscia, it appears that other people also seem to have settled there from outside the city.[29]

One might expect to see the building phases in Siscia only as a reflection of the increase in trade and activity that was occurring in the city and the region during this period. However, the vast majority (all but one for certain; see Figure 12) of the wooden building samples that have been recovered from the variety of contexts at Sisak date to almost directly after the granting of *colonia* status to the city in 71 CE. This suggests a deliberate and focused top-down approach to urban planning and development at Siscia.

The newly collected samples from the Forum may indicate an initial building period directly following conquest (within five years), but dating is problematic in this period because of the dearth of samples and the loss (lack of preservation) of the few samples (two in Figure 12) collected over two decades ago. We only have secure use dates after the city received *colonia* status. The samples come from a variety of different segments of the city, illustrating there was widespread building activity throughout the site during this period, but the aqueduct and river harbor appear to have been of prime importance directly after the city became a colony. The

29 The onomastic evidence from the lead tags supports the picture of a very mixed group of people in Siscia from diverse regions. Iconography in figurines, fibulae, and other items show a diverse group of gods traditionally from a variety of regions, as well as blending of these models. For evidence of “foreign” peoples located in a nearby town, Celeia (Celje), see Visočnik, 2014.

political status shift of 71 CE was thus not merely political; it may have provided the impetus for Siscia to be developed to more closely fit its new role as *colonia.* The status shift to *colonia* certainly represented an actual change in activity in Siscia, which certainly had a substantive impact on the people in habiting the city.

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