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Thinking Big. Research in Monumental Constructions in Antiquity

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Thinking Big. Research in Monumental Constructions in Antiquity

Ancient civilizations have passed down to us a vast range of monumental structures. Monumentality is a complex phenomenon that we address here as 'XXL.' It encompasses a large range of different aspects, such as sophisticated technical and logistical skills and the vast economic resources required. This contribution takes a closer look at the special interdependence of space and knowledge represented by such XXL projects. We develop a set of objective criteria for determining whether an object qualifies as 'XXL,' in order to permit a broadly framed study comparing manifestations of the XXL phenomenon in different cultures and describing the functional and conceptional role of the phenomenon in antiquity. Finally, we illustrate how these criteria are being applied in the study of large construction projects in ancient civilisations through six case studies.

Monumentality; XXL architecture; large technical infrastructure; Mesopotamia; Eurasia; Rome.

1 Introduction[1]

What significance did extraordinary size – what we call the 'XXL' phenomenon – have for the societies of the ancient world? This was the question that the scholars who initiated the project *XXL – Monumentalized Knowledge. Extra-Large Projects in Ancient Civilizations* decided to explore inspired by the vast temple complex at Baalbek (Lebanon). In many cases, the monumentality that characterizes XXL projects is not confined to physical scale: the creation of these unique phenomena involves a combination of great technical ingenuity, extraordinarily high levels of skill, the devotion of vast amounts of time to building them, the type and range of the resources invested and the sheer size of the task. These projects exceed, no, they explode through the normal dimensions, and by doing so they evoke with exceptional clarity the engagement with space and materiality, with feasibility and innovation in overcoming the apparent limits of the possible. Thus, XXL projects, according to our thesis, embody the mutual interdependence of space and knowledge in quite a special way. Two sets of questions guide our analyses: *1. Knowing How:* What factors define the different stages of the realization of XXL projects – both in terms of their development within space and with respect to the mobilization and development of technical and systematic knowledge – and how do they tie in with the history of ideas? *2. Knowing Why:* What is it that leads a society to invest the vast amount of energy and resources needed for a megaproject?

1 The present manuscript was submitted in summer 2014 as a preliminary summary of our research results at that time. We have been unable to incorporate more recent results of the ongoing project.

Our research group is investigating the XXL phenomenon with methodologies drawn from archaeology, philology, the history of technology, cultural anthropology and historical scholarship – in a project that encompasses very different cultural spaces and very different societies in the ancient world. The definition of the attribute 'of extraordinary size' from the perspective of modern researchers is therefore of central importance for our comparative approach. We have chosen to use the abbreviation 'XXL' as a way to express the fact that in addition to being 'large' in a neutral sense, the phenomena in question convey an impression of monumentality that hinges on other factors as well, such as their proportions and the perspectives from which they are viewed. 'XXL' also allows us to avoid a premature commitment to one genre classification, such as 'monumental buildings', and therefore does not beg the question of what role an architectural structure played in its culture.

This contribution focuses on the development of a common approach to the study of XXL phenomena in the (re)construction of historical spaces. After providing an outline of the terminological, conceptual and methodological premises and requirements, we will turn to a description of the range of the XXL phenomenon in the ancient world with regard to their functions and types of structures. We then discuss six case studies in order to illustrate the way our research group is implementing the criteria it has developed within our investigation of large architectural structures from antiquity.

2 Reflections on method, terminology and the concept of monumentality

One recognition from the field of hermeneutics is that new knowledge is defined not only by the object of knowledge itself, but also by the interpretational background against which newly acquired information is positioned and understood. Part of what shapes our understanding of ancient large structures is the way in which terms such as 'monumentality', 'gigantism', 'colossal scale' and 'vastness' relate to each other and how these terms have been interwoven throughout their reception history *(Wirkungsgeschichte)*. Below, we examine the term 'monumentality' as a case in point.

People using the term 'monumentality' who wish to distinguish it from 'gigantism', for instance, often emphasize relational and proportional aspects to do so.[2] A linguistic usage that was quite common well into the 18th century continues to influence our reception of this term today: the word 'monument' (from the Latin *monere*: to admonish, warn, remind) referred to memorials and sites of remembrance – initially with no connotation of size, and not necessarily in relation to an architectural structure. Extraordinarily large structure and classical perfection were not encompassed within the definition of 'monumentality' until the 19th century, when those aspects were introduced in the context of national representation and historical legitimization. The aspect of the sacred[3], which is now also

2 "True monumentality is indeed not expressed in the size, but in the relationship to the figure of the observer and, put in highly emotive terms, the inner imbuement [*Durchdrungenheit*] of a work." Küster 2009.

3 See Kuhlenkampff 1991; c.f. as an example, the formulation in Meyer 1938, 123: "Rather, the difference between the monumental and the non-monumental is, across the board, of the same nature as the more specific difference between the sacred and the profane. It is a difference in the tone, in the aspiration expressed in the composition, i.e., in the purely aesthetic, and one which has nothing to do with the external material expenditure per se and does not depend on complexity in the use of forms [*Formenaufwand*]. No matter how large silos and factory buildings: they may inspire feelings of awe, be overwhelming or colossal, but by no means monumental for that reason, and conversely, the black serpentine paperweight on the table of the director general can be monumental without being big. And the giant stadium or the Hudson Bridge only become monumental when they manifest themselves externally as expressions of state ideology, in addition to and outside the scope of their technical achievement, in other words, when

connoted by the term, relates to the concept of the 'sublime' developed in the aesthetics of Kant, Herder, Paul and Schiller: in Kant's definition, that "which is beyond all comparison great"[4], and as "awe-inspiring greatness."[5]

As 'monuments', the commemorative structures of the 19th century AD conveyed national symbolism. The motif of the transcendence of temporal and spatial restrictions implicit in this use of the term 'monument' was carried over into archaeological and art historical research on large structures from the ancient world, and has therefore continued to be one of the most influential aspects affecting the reception of the word up to the present day.[6] Writing in 1943, Sigfried Giedion was able to summarize the modern understanding of 'monument' in his *Nine Points on Monumentality* as follows:

Monuments are human landmarks, which men have created as symbols for their ideals, for their aims, and for their actions. They are intended to outlive the period which originated them, and constitute a heritage for future generations. As such, they form a link between the past and the future.[7]

A great many of the national commemorative structures erected in the 19th century were directly inspired by structures from antiquity, such as the Parthenon in the case of the Walhalla memorial (1830–1842) in Bavaria. Thus, 'monumentality' was at first firmly linked with the classical architectural form – to the direct reference to 'monuments', in most cases of ancient Greek or Roman origin. In this respect, the relationship between contemporary structures and the study of antiquity was always apparent:[8] architecture reflected the contemporary interest in the remains of large structures from the ancient world. This interest was also expressed in the reconstructions of Roman, Greek and Egyptian ruins and the detailed views depicting such ruins.[9] The situation was more complex in the case of architecture though: new architecture drew inspiration from antiquity, certainly, but it also entered into direct rivalry with the ancient 'monuments' and transplanted them to new urban contexts – for example, Washington, D.C., garbed in the image of the Roman Capriccio, in the 19th century,[10] or the design of Rome's center, where structures from antiquity were presented as monuments in ruins, set apart from their urban context.[11] In Rome one also encounters antique monuments juxtaposed to modern monuments – at the Monumento Nazionale ('il Vittoriano', 1885–1927), which was positioned directly adjacent to remains from the Roman era.[12] In the 20th century, monumental architecture opened itself up to new influences, whose origins lay outside of the classical tradition – in architecture from the ancient Near East or pre-Columbian America for instance[13] – while expressionism elevated the monumental aspect and abstracted it, stripping it of its references to the past.[14]

they are emotionalized beyond their purely functional character by means of special activities, when they are transposed into a quasi-sacred tone."

4 Kant 1990, § 25.
5 Kant 1995, § 65.
6 See Ruhl 2011b.
7 Giedion, Léger, and Sert 1993.
8 Meyers 2012, 12–13.
9 For the Roman monuments, see Medici, beaux-arts, and Francia 1985.
10 Gampp 2011, 237–243.
11 Altekamp 2011.
12 Atkinson and Cosgrove 1998, 35.
13 The American architect H. W. Corbett took the Tower of Babel as a comparison for designs of highrises in New York in the 1920s; in the same period he also planned the reconstruction of the Temple of King Solomon, drawing on architectural historical studies of construction techniques in the ancient Near East; E.J. Kahn, drew inspiration from Mayan step pyramids, which in his eyes symbolized an indigenous American culture as a counterpole to European culture, also relying on information from in-depth archaeological architectural studies: Magnago Lampugnani 2011, 165–16.
14 Ruhl 2011b, 27–29.

Giedion's 1943 manifesto, quoted above, marked a final break with the close connection between ancient and modern monumentality. It came toward the end of a period in which the dictatorial regimes in Germany, Italy and the Soviet Union drew extensively on a neoclassical, monumental language of forms. Mussolini devoted massive resources to urban redesign, using ruins from antiquity as set-piece elements in the creation of his fascist Rome;[15] seven Stalinist skyscrapers erected in central Moscow during the 1940s and 1950s fundamentally transformed the cityscape;[16] and Speer, planning to redesign Berlin, envisaged an oversized domed structure at the northern end of a central military parade axis.[17] As a result of this instrumentalization of monumentality for political purposes and the incorporation of monumental structures in designs intended to showcase totalitarian power, the classical monument as an expression of architecture largely fell out of favor after 1945. Giedion himself speaks of a pseudo-monumentality of the past that must be replaced.[18] A distinct ambivalence had entered into people's view of monumentality in architecture, even where there was no evocation of antiquity. It is true that some architects – following Giedion's manifesto – had begun searching for a 'new monumentality' in the 1940s. Indeed, in the 1950s, new monuments that adhered to Giedion's principles were created in three planned cities built to serve as national capitals – Chandigarh, Brasilia and Dhaka. These are highly expressive landmarks standing as symbols for the state communities whose political centers they formed.[19] However, the majority of the architects of the post-war modernist era no longer saw the creation of symbolic architectures as their role. Starting in the 1960s, 'old monumentality' approaches began to come under fire from fierce criticism.[20] This shift came hand in hand with another, as scholars of antiquity began turning their focus away from large architectural structures, which once broadly dominated the study of ancient architecture, and started to concentrate more on the analysis of smaller architectural complexes and urban building contexts instead. When researchers did study large structures from the era of the Roman Empire, they tended to investigate the political-ideological function those structures may have served rather than their direct material form and impact: it was the social rather than the architectural phenomena that attracted their attention.[21]

It appears that in recent years another shift has been taking place, one that is again manifesting itself both in modern day architecture and in the study of architectural history. The change emerges with striking clarity in the Federal Republic of Germany after World War II. A definite reluctance to erect large state buildings was apparent there, in no small part as a consequence of the political use of architecture of the 1930s. There has been no sign of that reluctance since reunification though:[22] a monumental chancellery now stands unabashed opposite the 19th century Reichstag building, a far cry from the Kanzlerbungalow in Bonn, which seemed to shy away from the attention of passers-by.[23] In the USA, Daniel Libeskind's design for the new World Trade Center building is a highly expressive monumental structure packed with symbolic references which intends to fulfill the landmark's function of creating community, in the sense expressed by Giedion. The

15 Altekamp 2011.
16 Ikonnikov 1994.
17 Bärnreuther 2000, 204–208.
18 Giedion 1944, 550.
19 Magnago Lampugnani 2011, 721–751. On the 'new monumentality' see Ksiazek 1993, 417–420; Tallack 1994, 162–166; James-Chakraborty 2011; Moravánszky 2011.
20 An example is the famous document by R. Venturi and D. Scott Brown "Learning from Las Vegas"; see Stierli 2011.
21 This is in the context of the *linguistic turn* (Bachmann-Medick 2006, 33–37) and applies e.g. to the investigation of imperial architecture in Rome: see the works by R. H. Darwall-Smith 1996 on the Flavian period and by F. Coarelli 1986 on Maxentius.
22 Bartetzko 2004/2005.
23 Maak 2004/2005.

monument – even if no longer in its classical form – is again shifting into the focus of attention. As the tension that once marked this field dissipates, scholars of culture, for their part, are now able to pursue new avenues in their investigation of the monumental structures of the past.[24] Turning away from the glorification of 'monuments' and the concentration on stylistic and formal aspects (the dominant approach well into the first half of the 20th century), they are seeking to understand the architecture of oversized structures not in isolation, but as part and parcel of the broader social fabric of their time.[25]

This turn has also resulted in the bridging of a longstanding and crucial divide: it has become possible to integrate the motif of political, aesthetic, existential and religious glorification dominant in the 19th century with decisively 'modern' 20th century attributions, such as functionality, democratization and a focus on utility, into a broader spectrum of possible interpretations. This spectrum includes the function of community-building through communal activity, the motif of social pacification through the harnessing of an unoccupied workforce, the representation of power and social status, the embodiment of wealth and technical skill, the function of deterrence in sense of military psychology, and the motif – already prominent in antiquity – of the hubris of tyrannical rule.[26]

3 Three major types of monumental constructions – Case studies

Realizing that preconceptions of the modern viewer can be the source of an impression of monumentality, our research group decided on a specific methodological approach intended to at least minimize that risk. We examine (1.) how the object's size relates to the surrounding buildings; (2.) the relationship between the human, natural and other resources required to build an object and the economic capacities available; (3.) whether there is evidence of *antique* attributions of monumentality, in the form, for example, of inclusion in the list of wonders of the world (this would be revealed solely in written sources or other explicit contemporary evidence; in many instances such sources are unavailable however); and (4.) the conceptual and scientific premises underlying our modern attributions.

These efforts to objectivize the attribution of monumentality substantiate, at least in some way, the suspicion that an architectural structure that appears monumental to the modern viewer was also a structure of 'extraordinary size' in the antique cultural context. The research group has defined a set of criteria intended to permit a comparative

24 On the focus on the monumental in archaeology: Vol. 22.2 (1990) of World Archaeology on "Monuments and the Monumental"; Thomas 2007; Meyers 2012. Monumentality in cultural studies: ring lecture "Dimensions of the Monumental" at the Humboldt-Universität Berlin (winter semester 2007/2008, http://www.kunstgeschichte.hu-berlin.de/2007/10/ringvorlesung-im-wintersemester-2007-2008/ (visited on 04/05/2016)) and the conference "Mythos Monument" at the Art History Institute of the Ruhr University Bochum (January 2010; cf. Ruhl 2011a). Issue no. 755 (April 2005) of the Swiss cultural magazine "du" focuses on "Architektur und Macht. Eine monumentale Verführung" ("Architecture and Power. A Monumental Temptation").

25 See the DFG focal programme begun in 2009: "Early Monumentality and Social Differentiation" (http://www.monument.ufg.uni-kiel.de/schwerpunktprogramm/ (visited on 04/05/2016)). The performative function of large-scale structures is coming under increasing attention, as one can see, for instance, in the discussion on the architecture of the Cathedral of St. Denis in papers presented at congresses in Rome ("Art and Liturgy in the Middle Ages," 1997) and Lausanne-Fribourg ("Art, Céremonial et Liturgie au Moyen Age," 2000).

26 See the representation of the backgrounds and incentives in the construction of the pyramids in Herodot 1971, II, §§ 124–134.

cultural investigation of antique 'XXL buildings'. We consider an object to be XXL when the majority of the following criteria are met:

Size: the spatial dimensions of the object cause it to stand out significantly vis-à-vis the surrounding norm.

Position: the object's exposed position relative to the surrounding buildings causes it to stand out, e.g. it was sited on a mound or hill or in the center of a settlement, or at a location, possibly even a peripheral location, that developed into a center as a result of the object's presence.

Permanence: the object dominated the surrounding area over a long period of time.

Investment: construction of the object involved abnormally large investment relative to the technical or economic potential (skills, knowledge, tools, cultural techniques) of the population and/or its size; construction may even have involved investments and hence risks on a level disproportionate to the population's capacities.

Complexity of the project: the technical knowledge, the artisanal skills and the organizational and logistical effort required to construct the object exceed both qualitatively and quantitatively the levels entailed in construction of a structure reflecting the norm for the surrounding area. Thus, for example, an object that is 'large' in terms of its dimensions but that was formed through the agglomeration of many smaller objects, which themselves reflect the norm for the surrounding area, may not necessarily be 'large' in terms of the complexity of the project object, its impressive size notwithstanding.

3.1 Large 'special buildings' and the architecture of power: Oversized architecture (case studies 1, 2, 3)

The creation of an architectural space is preceded by decision-making processes concerning, for instance, the dimensions of the space to be constructed and the selection of resources (building materials) to be used. From the perspective of cultural anthropology, an investigation of the parameters that may have influenced the size and/or design of a building and its fixtures and furnishings can be a rewarding endeavor.

Recent excavations have ruled out the notion of a long-term linear evolution from small to large, or from sparsely to elaborately furnished architectural structures, replacing it with the recognition that architectural scale is influenced by culturally specific and/or social factors. We now know that as early as the Neolithic period the architectural spectrum already encompassed a wide range of structural sizes, as well as very large complexes. In the Near East, we see this in what are called the 'special buildings' *(Sonderbauten)*, such as those at Göbekli Tepe in south-eastern Turkey.[27] Size was used as a distinguishing characteristic in later periods as well, and it seems to have been influenced both by contemporaneous residential architecture and by its architectural predecessors.

In the Neolithic Near East and Europe, household communities already tended to follow a single plan typical for the entire settlement (buildings of a standard design)[28] when they erected structures. Modifications to the building ground plans affecting size, and therefore floor space, indicate that the household communities that built them had a variety of needs. Modifications of this type are probably related to the size of those communities and the intended uses of the structure. Social factors, such as family size, functions related to assemblies, social and economic hierarchies and the needs of the community with respect to housing, production or storage facilities have all been discussed in this context.

27 Kurapkat 2010.
28 Eichmann 1991, 3. 73–82.

Occasionally, the largest buildings at a site featured special, exclusive architectural design elements which set them apart from other structures in the area. Some of these elements are motivated by structural concerns (supporting pillars and walls of double thickness); some serve to meet particular spatial requirements (rooms that are subsequently added, or the inclusion of an additional series of rooms during the planning stage).[29] In the Near East, the modification of standardized buildings tends to increase with increasing diversification of socio-economic conditions; in some instances, the alterations are so extensive that it is no longer possible to discern the standard design in them. Sometimes special architectural features distinguish structures of the standard design. The articulation of facades by pilasters and niches,[30] a feature typical in the Near East, has structural origins, but it also reflects the solidity and special character of the building, and it is possible that we should understand this feature as a reflection of the strength of a social group. Structural features of a building may have become architectural symbols of social identity in this way. Over the next millennia of Mesopotamian history, this articulation is a consistent design feature of temples, and in some instances of palaces as well.

One way of determining the investment associated with (what is posited to be) an extra-large construction project is to quantify the difference between the amount of work involved in the construction of a residential structure and that invested in the 'special building'. The detailed information contained in texts written by the state administration from the end of the 3rd millennium BC onwards are highly illuminating in this respect. These texts contain information on the incoming and outgoing goods, on prices and value equivalencies, wages and the provisioning of workers, etc. Such texts provide evidence of the existence of knowledge, but they do so *implicitly*. They are a detailed reflection of the application of knowledge, and are similar in this sense to archaeological remains. By contrast, the surviving mathematical-metrological texts (known from approximately the 18th century BC onwards) do convey knowledge *explicitly*: these texts served specifically to store and communicate the knowledge in question. The information these texts contain includes parameters that are highly relevant to our investigations, such as information about average workloads. Several of the parameters reported in the economic records are also reported in the theoretical mathematical-metrological texts, suggesting that we would be justified in assuming that even those parameters as yet only evidenced in theoretical texts had some basis in reality. In many respects, the interplay between pragmatic and theoretical texts creates a quite precise quantitative picture of economic and administrative processes in many fields.

Case study 1: Extra-large tripartite buildings

A standard ground plan, called the 'tripartite building', emerged as the characteristic type for monumental structures built at a central location in urban settlements, primarily in the 4th millennium BC. Several large-scale excavations of these 'tripartite building' have been conducted, particularly in Uruk-Warka (Iraq). Noteworthy elements of these structures include, e.g., pilasters, thick walls, a special wall design (paintings, mosaics, carved ornaments) and unusual building materials. They could also feature large enclosed courtyards and special installations.

Monumentalized 'tripartite building' far exceed the sizes found in the spectrum of urban residential buildings. There can be no doubt that these structures served a function different from that of residential buildings, and they can certainly be understood as 'special buildings'. These are structures well beyond that which could have been built by

29 Pessedzik-Depe (Djeitun Culture): Eichmann 1991, pl. 15, fig. 52; Bouqras/Syria, 8th/7th millennium BC: Akkermans and Schwartz 2003, 122–124; Choga Mami and Tell Songor A, 6th millennium BC: Eichmann 1991, pl. 62–64; Tell Abada/Iraq, 5th millennium BC: Eichmann 1991, 101, pl. 71, fig. 261. 262.

30 First in Tell Abada: Eichmann 1991, 101, pl. 71, fig. 261. 262.

members of one family or one neighborhood; specialist artisans and a large number of workers must have participated in their construction.

Since the only buildings in Uruk from the second half of the 4th millennium BC that have been excavated are 'special buildings' – no residential areas from this time have been uncovered – we use a representative residential house from Habuba Kabira/Syria for reference purposes.[31] The Habuba Kabira structure consists of a tripartite building (approx. 148 m^2), some additional rooms and a central courtyard (Fig. 1), which, taken together, cover a total area of 500 m^2. Although generously proportioned for a house, it is not so large that it could not have been built by, for instance, members of one household assisted by relations or neighbors, i.e. without requiring centrally organized labor.

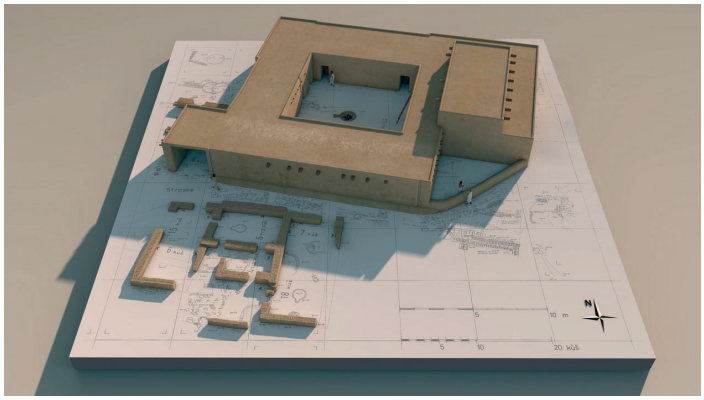

Fig. 1 | Reconstruction of residential building H in Habuba Kabira, southern perspective.

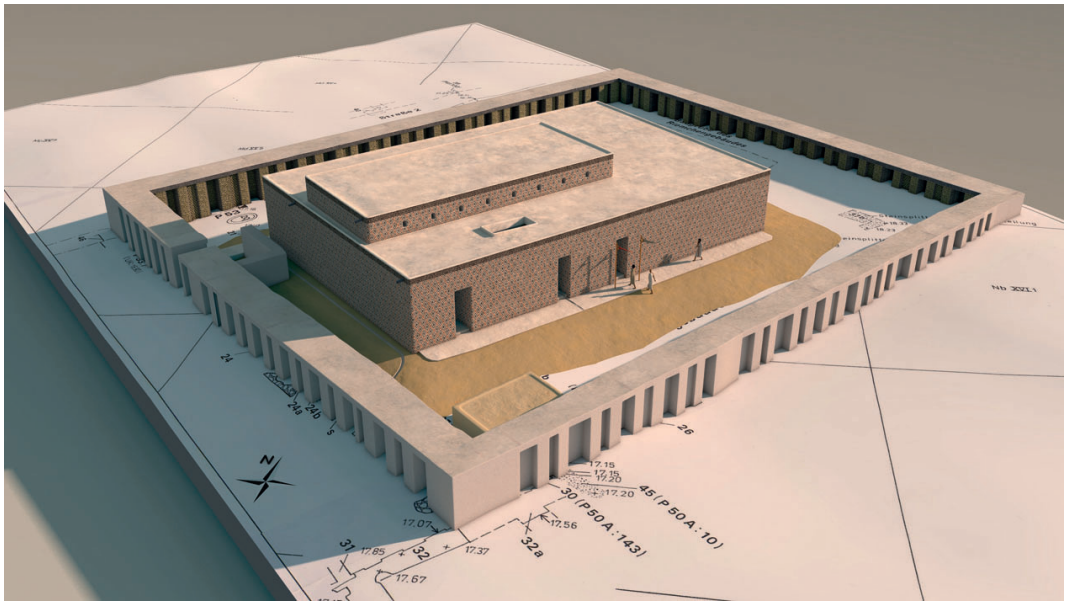

Fig. 2 | Reconstruction of the stone-cone building in Uruk, southern perspective.

31 Building H, also known as the 'Great House' (Frank and Ludwig 1973) and 'East House' (Strommenger 1980, fig. 16).

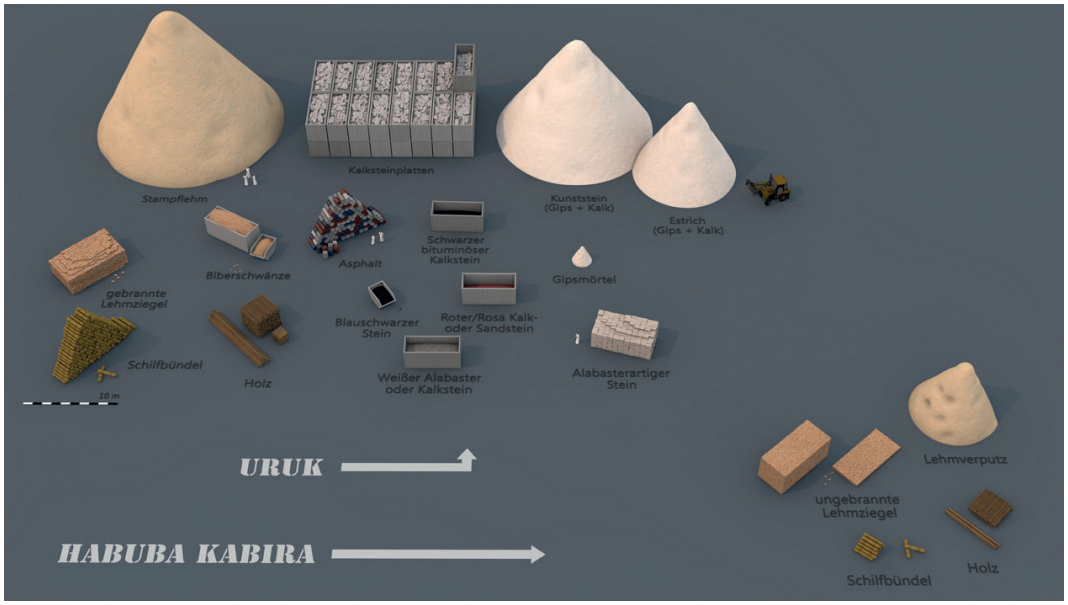

Fig. 3 | The construction materials from the stone-cone building (without surrounding wall) in Uruk (above left) and from the central hall section of residential building H in Habuba Kabira (below right).

The building known as the 'Steinstiftgebäude' (a.k.a. 'Stone-Cone Building'), discovered in Uruk, by comparison, features a tripartite structure with a base area of approx. 569 m^2.[32] The tripartite building stood on an elaborately constructed foundation terrace, upon which the building was created by applying layers of a white mortar which, once set, was as hard as concrete. The building's interior and exterior walls were coffered with a mosaic facade made of stone cones in three different colors. The excavators also unearthed an enclosure wall circling the building, the inner side of which was decorated with greenish and black clay cones (Fig. 2). The difference between the *Steinstiftgebäude* and the residential structure is not limited to the larger area of the former and the quantities of materials used; the variety and value of the materials are also key parameters (Fig. 3). Clearly, the creation of the *Steinstiftgebäude* involved a broader social context. It represents only one of multiple special buildings in the center of Uruk, some of which were significantly larger and very elaborately decorated. They were all razed at the end of the 4th millennium BC, and a sanctuary to Uruk's city god was erected in the city center. That sanctuary is thought to have survived into the 2nd century BC. It underwent renovations on multiple occasions during that period, and extensive new construction work was carried out from time to time.

Case study 2: Central urban sanctuaries

King Ur-Namma (2112–2095 BC), the first king of the Third Dynasty of Ur (Ur III), undertook a fundamental restructuring of the main sanctuaries in southern Mesopotamia. The construction design developed for that purpose at the king's behest became canonical and was used both in Uruk and in many other locations in southern Mesopotamia.[33] In terms of size, the Eanna sanctuary in Uruk surpassed its predecessors, the scale and prominence of which had already caused them to dominate the center of the city. The Eanna sanctuary occupied an area of at least 140 000 m^2 in this period.[34] Its central element was the

32 Eichmann 2007, 364–386.
33 Van Ess 2001, 310–322; Nissen 2006, 64.
34 It is unclear how many courtyards there were. There may have been two additional, as yet unexcavated, courtyards connected to the ziggurat in the south-east and east.

ziggurat, made up of two stacked high terraces of massive brickwork, on top of which stood a temple, to which an elaborate system of stairs provided access. The ziggurat was surrounded by several courtyards serving different functions.

Height becomes a special criterion in this complex, erected on an elevated site and rendered even more potent by the oversized dimensions of its various structural elements. The lower ziggurat terrace, at 11.2 m tall,[35] is transmuted into a raised terrace. A total height of 28 m can be reconstructed for the sanctuary as a whole. Larger than every other building, it towered over the entire city; the monumental complex would have been visible from far and wide in the flat landscape of southern Mesopotamia. Its visual prominence was increased by the niche-and-buttress articulation of its outer facades and gates, and probably also through particularly light-colored plaster that made it seem to sparkle.[36] Table 1 provides a summary of the dimensions; only the figures for the clay bricks, the main building material, have been compiled.

A comparison with contemporary residential architecture is illuminating with respect to expenditure on construction. Peter Miglus has analyzed house floor plans from the 2nd and 1st millennia BC with regard to room functions, construction processes and average sizes of houses. For the Isin-Larsa and Old Babylonian period – not so long after the Ur III period – there is evidence of houses featuring rooms grouped around a courtyard (courtyard houses) with a reception room on one side. The majority of these houses are less than 100 m^2 in size,[37] although a large number of 100–200 m^2 houses have also been documented. Taking as our reference House 2, Straight Street, from the Isin-Larsa period in Ur, a well-preserved 10-room, 185 m^2-house,[38] we can estimate a required outlay of 400 m^3 of construction material – clay bricks (assuming a room-height on the ground floor of 4 meters[39] and the existence of one upper floor with an area equivalent to 50% of the house's base area[40] and a room height of 3 m).

Thanks to the mathematical-metrological texts, we can assign figures for the logistical and technical outlay with a high degree of confidence. These texts include information about characteristic standards, such as materials constants and average workloads. On the basis of that information, we have calculated the amount of time required to produce the bricks needed for this house at 467 man-days.[41]

Approx. 800 man-days would be required to transport the bricks to the construction site over a fictional distance of 360 m, with an additional 160 man-days necessary for the actual masonry work.[43] At this point, the time and effort demanded for roof construction and plastering the house need to be determined empirically; the requisite reed mats and bitumen also had to be procured. We are assuming a total of 223 man-days, a rough estimate, for that work. That would mean that building the house required an investment of approximately 1600 man-days, i.e. about half a year with 10 workers drawn from the family and/or the neighborhood. These are maximum values: most houses could have been completed using only half the quantities of material.

35 The same heights were ascertained for the ziggurat in Ur.
36 Van Ess 2013, 204–205.
37 Miglus 1999, 78.
38 Miglus 1999, 282, pl. 33.
39 Evidence has been found of a height of up to 3.85 m, without the start of the roof structure being detectable: Miglus 1999, 19–20 and 65. This would not necessarily have been the case for all rooms in the house.
40 Reasons for assuming the existence of upper floors are given by Miglus 1999, 76. He estimates a maximum of 50% of the living area as an upper floor. The height of the room is arbitrarily selected.
41 The calculations draw essentially on Robson 1999, 75, adapted by text evidence in Heimpel 2009, 223–224 and ethnographic data.
42 The high terraces differ in size and height, the facades are banked. The areas and volumes must therefore be calculated separately for each partial building element. A detailed breakdown is not given here.
43 Robson 1999, 165.

Building element	Dimensions/Area	Building volume overall	Number of clay bricks required
Ziggurat	Base area: 56 m x 48 m on a foundation platform with side lengths 61.2 m, 68 m, 74.5 m, 61 m[42]	41 540 m^3	12 217 470
Inner zingel	3827 m^2	24 876 m^3	7 316 323
Surrounding zingel of the pillared courtyard	1896 m^2	12 324 m^3	3 624 706
Encompassing zingel of the fore-courtyard	731 m^2	4752 m^3	1 397 500
Outer zingel around the south-eastern and north-western courtyard	6110 m^2	39 715 m^3	11 680 882
Balustrades on the ziggurat and zingel, hypothetical reconstruction	4816 m^2	1204 m^3	354 118
Total		124 409 m^3	36 591 000

Tab. 1 | Uruk. Dimensions of the Ziggurat built by king Urnamma (2112–2095 BC) and calculation of the mud bricks required for its construction (calculation by Judith Ramadan).

Materials similar to those used in constructing residential structures have been archaeologically documented for the Eanna sanctuary in Uruk. Original sources also contain references to luxury materials, such as special varieties of stone, metals and hardwoods used in individual parts of the building and movable fixtures. Almost all of these materials were imported, and they were, as a rule, provided by the king. Although long-distance trade was a part of the state economy, as was all of the other work performed, it can be classified as a special provision by the crown to a greater extent, and will therefore be assessed separately.

So far, the analyses of buildings in the major southern Mesopotamian cities of Uruk and Ur have provided us with quantitative estimates for the material and human resources involved. Below, we present several aspects of the work involved in constructing the ziggurat of Uruk, taking those estimates as our basis. Additional aspects, such as the procurement, production and processing of materials typically used in the construction of large structures, e.g. ropes, mats, bitumen and wood, will be calculated elsewhere.

According to our calculations, around 12 217 000 clay bricks were used in the ziggurat, with a total structure volume of 41 540 m^3. Each brick weighed approximately 5 kg. For the sake of greater transparency, we use these same figures in the calculations below. This

transparency comes at the cost of inaccuracies caused by estimation errors and of results that appear over-precise; we have decided not to estimate error margins for the purposes of this paper. Given an average workload of 1.5 m^3 per man-day for brick production, we arrive at a total labor investment of 27 693 1/3 man-days for brick production. Texts from Ur III Garšana document the fabrication of bricks with a wage of 5 liters of barley per person per day,[44] i.e. per man-day. This wage is well documented elsewhere as well. Thus, a total of 138 466 2/3 liters of barley would have been expended on brick production.

Clay, the main raw material involved, was sourced from clay pits. Field plans show units identified as clay pits located at the edge of areas used for agricultural purposes (i.e. outside of the city), see Fig. 4 and Fig. 5. The fields were usually quite large but the clay pits were situated close to a canal, and the other raw materials required for brick production, such as water and chaff, were sourced directly from the fields. Although the texts do not specify whether actual fabricated bricks or just the clay mixture were transported into the city, we can assume, along with Wolfgang Heimpel, that the production of the bricks took place close to the fields.[45] Evidence from a text from Girsu[46] corroborates that assumption. The obverse of the tablet has a field plan showing two directly adjacent areas, one identified as 'ka-al', clay pit, and the other as 'dúl', water hole or basin: these are entered together as 'dúl ka-al' in the booking entries on the reverse side, implying that they comprised a single unit even in administrative terms.[47] If we assume that boats were used to transport bricks to the construction site, then costs arise for transportation during brick production, for transportation of the dried bricks to a stacking site or directly to the boat, and again from the boat to the construction site/stacking site. The daily workload for one brick-carrier is 486 000 kg m. To elucidate: that means that one worker could carry 100 bricks, at 5 kg per brick, over a distance of 972 m over the course of one day. In the Garšana example, the distances to be covered between the assumed production site of the bricks and the construction site were between c. 420 and c. 720 m.[48] Garšana was quite a small settlement and, significantly, one which did not engage in agriculture, according to the written sources. Nevertheless, we are taking these values as representative, because we are assuming that boats were used to transport the bricks from the vicinity of the production site to the construction area. The standard wage for the female carriers was three liters of barley per day. Assuming a transport route from the boat to the construction site of 600 m, and another 50 m from the brick production site to the nearby canal, transporting the 12 217 000 bricks for the ziggurat required approx. 81 700 worker-days at a total cost of about 245 100 liters of barley.

There is an Old Babylonian mathematical problem text[49] that includes an exercise for calculating the volume of a wall with a trapezoidal profile, for instance a dam with sloping sides, (length 360 m, height 3 m, lower width 6 m, upper width 3 m) and the number of workers/amount of work required to complete it (more precisely: the number of workers required and the portion of the total wall length whose construction would fall to one worker). For this wall, which has a volume of 4860 m^3 (corresponding to 437 000 bricks of the type above), 1620 workers are required, with each worker expected to complete an approx. 0.22 m length of wall. The calculation of the amount of work required is based on a standardized workload, one of 3 m^3 per worker, per day. Therefore, the construction of a brick wall with a construction volume of 41 540 m^3 required c. 13 850 man-days for a total cost of c. 20 775 liters of barley, given an average wage of 1,5 liters of barley per

44 Heimpel 2009, 223.
45 Heimpel 2009, 222.
46 HSM 1659 (Edzard 1962, 81).
47 Brunke 2012, 42.
48 Heimpel 2009, 226.
49 BM 85194. Discussion in Neugebauer 1935a, 142–193; photo in Neugebauer 1935b, plates 5,6.

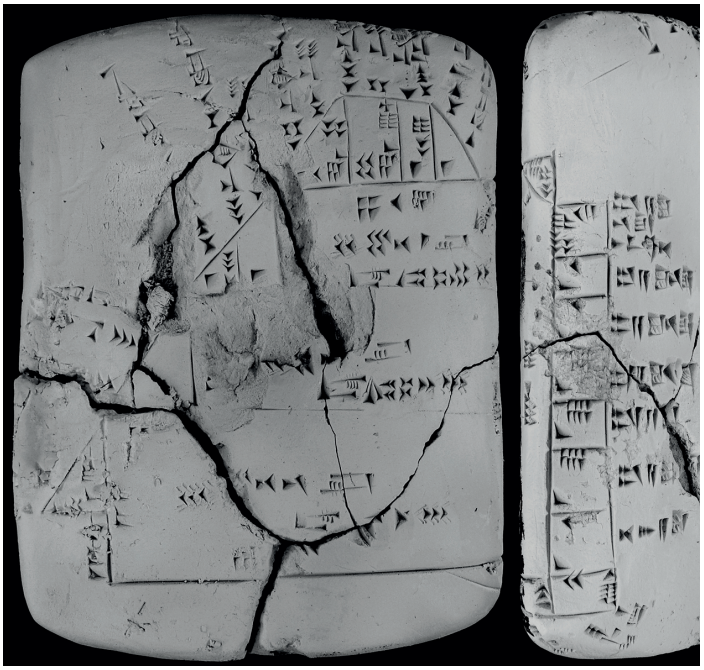

Fig. 4 | Ur III-era field plan JON 40 from southern Mesopotamia (approx. 76 mm x 103 mm).

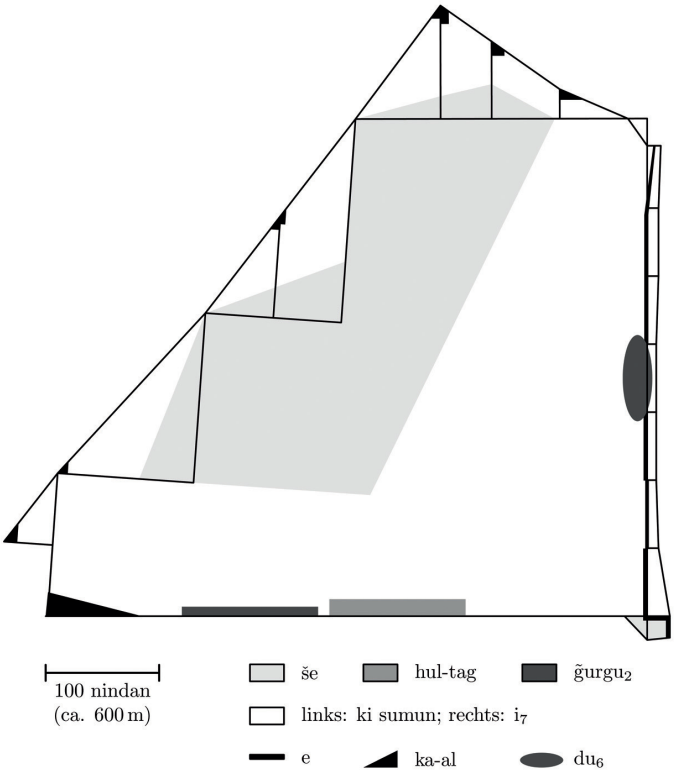

Fig. 5 | Schematic illustration of the field area portions, in particular the clay pit portions (ka-al) on the JON 40 field plan.

day per bricklayer. These rough calculations, which do not include the other activities involved, such as the mixing and transportation of mortar, cutting and transporting of straw for thinning and (in the case of fired bricks) of reeds for burning, yield aggregate costs of approximately 405 000 liters of barley for wages for the clay brick structure of the ziggurat alone.

Added to the wage costs are the costs for feeding the workers on site. According to the findings from Garšana, average worker rations consisted half-liter portions of bread, beer and soup,[50] presumably with larger rations going to those doing heavier work, such as brick carrying, or holding positions of greater authority. Then, too, this isolated find from Garšana may not be representative: according to the mission reports from Iri-Saĝrig, rations containing at least one liter of soup and fish, as well as two-liter rations of bread and beer, were allotted to simple laborers there.[51] The expenditure, including production costs, for every ration containing half a liter of bread, beer and soup, corresponds to that of approximately one and three quarters to two liters of barley. Therefore calculating with the approx. 123 250 laborer days for the masonry construction of a ziggurat obtained from the considerations above, the minimum food costs for workers alone again come to around 250 000 liters of barley, over and above the wage costs. This means that the total labor-related expenses for the clay brick structure of the ziggurat can be estimated at approx. 0.65 million liters of barley.

Fluctuation in field yield rates was relatively high, but we can take approximately 900–1 350 liters of barley per hectare as a reference value. With two harvests per year, and assuming a construction period of 10 years, this would mean that an average of around 46 cultivated hectares were required to pay and feed the laborers. It would be difficult to ascertain what percentage of the total barley cultivation that figure represented. Forty-six hectares would probably have been a negligible amount in large centers such as Umma or Girsu, however. We can also assume that large-scale projects received contributions from the central government drawn from the substantial tax revenues it received from all provinces.

The analysis of the expenditure on labor and, in particular, the assessment of those costs in relation to the total (agricultural) production of the Sumerian state suggest that the construction of a ziggurat did not represent a significant burden on the economy and thus that it was not 'monumental' from an economic standpoint. However, the ziggurat does qualify as a monumental structure from the standpoint of the investment of material, in comparison with the material input for a normal building, the logistics on site and the existence of special architectural features. A similar picture emerges from descriptions from antiquity of a hymnal and literary nature. These texts emphasize the sovereign's duty to carry out construction projects of appropriate grandeur, and hold out the promise of monumental prestige as a reward for erecting such architecture of power. However, that it was the hubris of rulers that was expressed in monumental forms was already a widely used topos in the ancient world. The question arises, then, as to how far the construction of architecture of power, for example, the palaces of the Roman emperors on the Palatine Hill in Rome, represented a special logistical challenge in the eyes of the community.

Case study 3: The Palatine Hill in Rome

To date, no investigation of the question of the labor expenses relative to the society's total potential capacity has been conducted for the architecture of Roman palaces. However Janet DeLaine's recent research[52] on the Baths of Caracalla and the even more recent research by Rita Volpe[53] on the Baths of Trajan have clearly established the Romans' ability to complete large-scale construction projects of that sort within very short spaces of time. Flavian-period construction of the new complex of palaces, the main phase of which can be dated to the reign of Emperor Domitian (81–96 AD), must also have been driven forward at a relatively fast pace. New research looking specifically at construction

50 Brunke 2011, 195–196.
51 Brunke 2013, 223.
52 DeLaine 1997.
53 Volpe 2002; Volpe 2010, Volpe and Rossi 2012.

techniques and brick stamps[54] has shown that construction work commenced roughly simultaneously over an area of approx. 96 000 m^2. Although clear evidence has emerged indicating that not all sections of the Flavian complex of palaces had been completed by the time of Domitian's death in AD 96, it is also evident that large parts must have been completed by the official opening in AD 92, i.e. within ten years of the start of construction. This could not have been accomplished without a continually replenished supply of construction materials, in addition to the necessary manpower,[55] including both skilled and unskilled workers, and a sufficient supply of working animals to meet transportation needs. To keep construction moving forward at a rapid pace, materials for building the basic structure, e.g. bricks, stones and the water and aggregates for mixing mortar (sand, chalk, pozzolana), had to be on hand in large quantities at all times, as did material for temporary structures at the site, such as the enormous quantities of wood required, primarily for formwork for foundations and arches but also for the vast amounts of scaffolding (Fig. 6).

Fig. 6 | Attempt at reconstructing the building site of the Flavian imperial palace on the Palatine Hill in Rome (end of 1st century AD).

The supply of building materials on such a scale was a gigantic project in its own right, one which could not have failed to leave an enduring mark on the Roman cityscape. Some of the materials, such as travertine, brick and basalt, had to be brought in from the surrounding area over distances of up to 60 km, and fairly recent research[56] tells us that the wood used had to be transported from present-day Umbria, over 100 km from Rome. Thus the ability to use the Tiber and its tributaries, none of which were easily navigable,[57] was of key importance for the procurement of matériel throughout the *urbs*. Ensuring the possibility of efficient use of waterways as traffic arteries for bringing the building materials demanded that an authority be in place to supervise and regulate shipping traffic. It is probable that a large proportion of the incoming material was unloaded into temporarily storage facilities close to the river (Fig. 7) before it was taken to the individual construction sites, in order to keep unloading times at a minimum. This means that

54 Bukowiecki 2008.

55 Janet DeLaine (DeLaine 1997, 175–194) calculated the manpower necessary to build the Baths of Caracalla, the central block of which covers an area of 24 000 m^2. For the 4-year construction period, she calculated an average of 7200 laborers per day to produce the materials and perform the building work, plus 1800 laborers and ox carts to transport the material from the environs of Rome, a figure which could even be doubled during periods of more intense activity. DeLaine 1997, 193.

56 Dionoso 2008, 251–283.

57 Le Gall 1953; Quilici 1986.

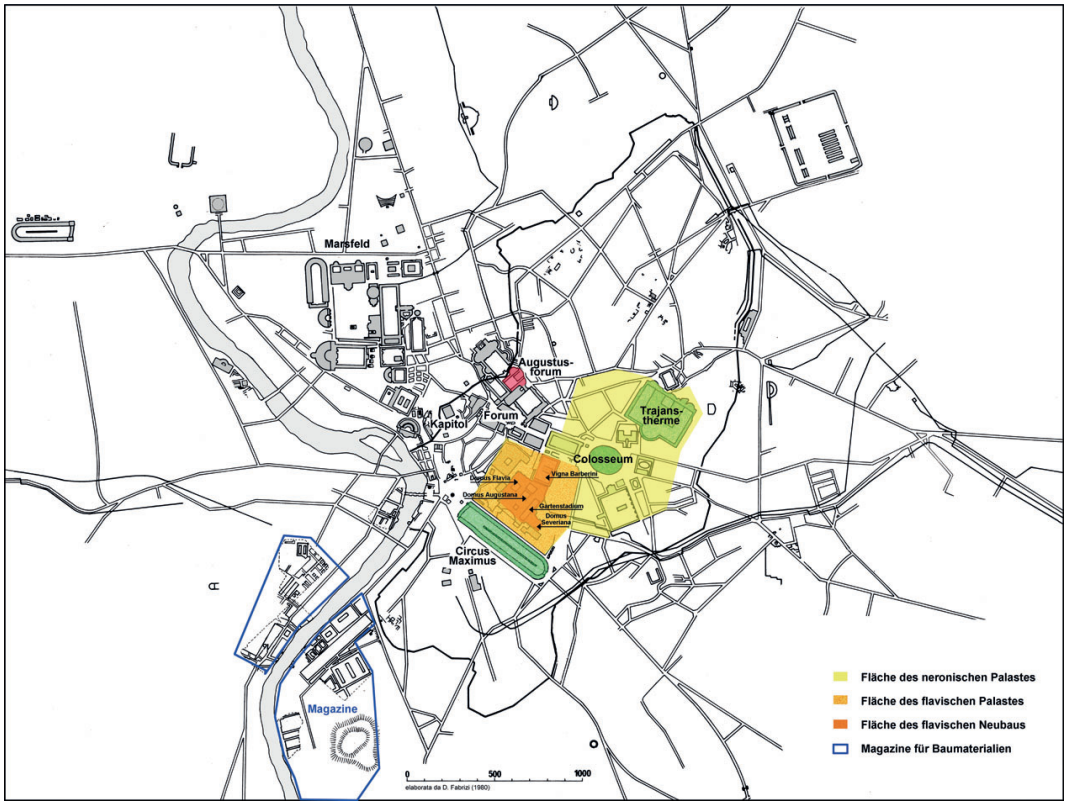

Fig. 7 | Area of the imperial Neroic and Flavian palace in the city of ancient Rome.

supplies then had to be shifted again, this time from the warehouses in the south-west of the city to the construction site on the Palatine Hill, a distance of over a kilometer. It is clear, then, that a smooth, efficiently operating logistical system was needed to supply the enormous quantities of building materials for construction of the imperial palaces.[58] The increasing influence of the emperor on the acquisition of building materials played an important role in that regard. The trend towards increasing use of fired bricks in large-scale imperial construction projects is a case in point: this was certainly not a coincidence but a deliberate choice representing both a technological and a symbolic change in the Roman building tradition. The manufacturing process used to make fired bricks was substantially more complex than the excavation of tuff, for example. It is very probable that the introduction of fired bricks was associated with a desire to manage the smooth procurement of supplies by setting up manufacturing facilities. With the introduction of masonry bricks in Roman construction, we also see the start of a process of brick-size standardization. Three standard sizes are rapidly established: *bessalis* (approx. 20 x 20 cm), *sesqipedalis* (approx. 43 x 43 cm) and *bipedalis* (approx. 60 x 60 cm).[59] This standardized manufacturing was the job of the *figlinae* (brickyards), situated by the clay pits in the upper Tiber Valley on large estates owned for the most part by families of great influence, even from the senatorial class.[60] Thus securing a stable supply of bricks was not the only result of the creation of a monopoly in production of the key building material: the switch to standardized bricks created a major source of industrial power in the Roman construction

58 According to DeLaine, material transportation costs alone accounted for approx. 24% of the total construction costs of the Baths of Caracalla (DeLaine 1997, 219–220 fig. 88).
59 Bukowiecki 2010.
60 See e.g. Andreau 2009; Setälä 1977; Steinby 1974/1975.

sector. By the start of the 3rd century AD if not before, the imperial family had an outright monopoly on brick production.[61]

We can obtain a clearer picture of the quantity of materials used in the Flavian-period construction through a close examination of the materials used to build the new parts of the complex[62] and the progress of construction work. On the basis of a detailed calculation of the number of bricks used in the 'garden stadium,' which was part of the Flavian complex (Fig. 7), we performed an initial calculation to give us an approximate value for the brick requirements associated with construction of the complex as a whole. The result: a minimum requirement of 150 000 *bipedalis* and 640 000 *sesquipedalis*. Assuming loads of 150 *sesquipedalis* or 100 *bipedalis* per kiln, which seems realistic, we find that at least 5000 kiln-loads were needed to manufacture the brick supplies for the wall shells and door and window lintels. For the production of the basic structural elements alone, around 7500 m^3 of brick supplies, requiring a storage area of about 6080 m^2 and weighing a total of 15 000 metric tons, had to be brought from the brickyards by the Tiber to the Palatine Hill, where some were stored before being transported to where they were needed on the construction site.[63] Bricks account for only a small portion of the total construction materials used however. Logistical feats of an even greater order were required to procure the vast numbers of decorative elements in the buildings and their fittings, which were made of marble from quarries throughout the empire. Clearly, only a highly streamlined, efficient and smoothly operating building industry could carry out large-scale construction projects like these within what were, in some cases, relatively short spaces of time.

We cannot assume that level of material investment alone constitutes a defining factor for the monumentality of any object, or group of objects, palaces included. On the subject of Nero's imperial palace, the Domus Aurea (mid-1st century AD), Tacitus (ca. AD 58–120) noted: "Nero [...] erected a mansion in which the jewels and gold, long familiar objects, quite vulgarized by our extravagance, were not so marvelous as the fields and lake, with woods on one side to resemble a wilderness, and, on the other, open spaces and extensive views. The directors and contrivers of the work were Severus and Celer, who had the genius and the audacity to attempt by art even what nature had refused, and to fool away an emperor's resources."[64] Here we can see that Tacitus does not measure the monumentality of the Domus Aurea in terms of the costly materials used in it or the luxurious appointment of its rooms. Instead, the emphasis is on the vast expanse of land claimed for the project in the densely built-up city of Rome and on the sums expended to reshape the grounds; these were clearly perceived as deviating from the norm. Obviously, it would not be appropriate to take statements like this one by writers from antiquity as representing *the* contemporary opinion,[65] however they do tell us that contemporary observers could understand the expansion of Nero's palace complex to be monumental in a negative sense.[66]

This has led many scholars over the centuries to see political considerations as at least partially motivating the abandonment of large parts of the Domus Aurea by the subsequent dynasty, the Flavians, who ascended to power in AD 69. The new complex of palaces was comprised 'only' of the Palatine Hill area, taking up a mere 180 000 m^2.

61 Bukowiecki 2010.

62 Consisting of Domus Flavia, Domus Augustana, the garden stadium and the Domus Severiana (see Fig. 7).

63 Bukowieki 2012.

64 Ann. 15,42. English trans. Church, Jackson Brodribb, and Bryant 1942. Originally quoted from Bergmann 1993, 18–19.

65 They were decisively influenced by opinions about the emperor and criticism of the senatorial aristocracy, see e.g. Winterling 1999, 76–77.

66 On the Domus Aurea, its expansion, its characterization as a 'landscape villa' and contemporary opinion, see Bergmann 1993, 18–25; Winterling 1999, 65–70; Beste 2012, 74–75.

Site	Size, in sq m	In comparison with Forum of Augustus (as quotient thereof)	In comparison with Flavian complex of palaces (as quotient thereof)
Forum of Augustus	11 500		0.06
Domus Aurea	800 000	53.3	4.4
Flavian complex of palaces	180 000	15.6	
New buildings in Flavian complex of palaces	96 000	8	0.5
Colosseum	22 000	1.6	0.12
Thermae of Trajan	90 000	6	0.5
Circus Maximus	82 000	5.5	0.45

Tab. 2 | Comparison of the size of important sacral and public structures of ancient Rome.

This means that the area occupied by the Flavian complex was less than one fourth that of Nero's palace (approximately 800 000 m^2). Can we take this to mean that the Flavian palace complex was no longer monumental, and not an XXL project? Again, sources from antiquity suggest otherwise. Here is the Roman poet Publius Papinius Statius describing the palace of his patron Emperor Domitian in his *Silvae*, a collection of poems, in the late 1st century AD: "… so do not hasten your ascent to heaven. So great a massive structure opens up, a spacious hall more boundless than a plain extends and vaults much sky in its embrace: only its master dwarfs it."[67] Even bearing in mind that boundless exaggeration and flattery was typical of such panegyrics to the emperor, Statius's emphasis of the palace's dizzying heights is striking. Again, it is the physical dimensions of the complex which, this time in a positive sense, are perceived as monumental (Fig. 7).[68] Nero's palace complex was more than fifty times larger in area than the Forum of Augustus, and almost 10 times the size of the Circus Maximus. Despite the reduction in size, the Flavian complex of palaces still occupied an area twice as large as that of the Circus Maximus or the Baths of Trajan, completed not much later under Emperor Trajan to become the largest *thermae* in Rome in the 2nd century AD (Table 2). In view of the immense area taken up by the complex within the territory of the city compared to that of other sacred structures and important public structures, we can conclude that the imperial palaces must have been perceived by contemporaries as monumental.

The location of the complex in the centre of Rome conferred an additional distinction on it which was the result of the historical significance of the site. At the end of the 1st century BC, Augustus had already made skillful use of long-revered sacred sites on Palatine Hill to create a quite special aura and a distinctive, public and yet also sacred character

67 Stat. Silv. 4, 2, 18. Nagle 2004 (English translation). Cf. also Winterling 1999, 71.

68 On the development of the palace overall: Winterling 1999, 47–75, Wulf-Rheidt 2002/2003; Wulf-Rheidt 2011.

for his residence there, primarily through the newly erected Temple to Apollo and the proximity to Casa Romuli, and thus to the mythical founder of Rome.[69]

However, the centrality of the imperial palaces also manifested itself in architectural terms in their prominent location within the city: 'monumentalization' is a continually recurring theme running right through history of the imperial palaces on the Palatine Hill. The Palatine is situated between three important sites: the Forum Romanum, the administrative center, the Circus Maximus, one of the most important crystallization points in public life, and the Capitol, the religious focal point of the city. The architecture of Palatine Hill took skillful advantage of that position: tall substructures created a raised platform, elevating the entire imperial palace above the surrounding structures, and thereby putting it at 'eye level' with the Capitol. This required a major feats of construction, involving the erection of high terracing walls and of multi-story substructures of up to 30 m high, as well as the shifting of vast quantities of earth. Atop this platform, the main floor of the palace was built, itself containing rooms with ceilings as high as 20 to 30 m. The inhabitants of Rome would surely have been aware of, and amazed by the sheer scale of the construction underway in the center of their city. Indeed, within a period of about one hundred years, the natural shape of the hill was so completely transformed that by the end of the 1st century AD it was possible for its architecture to present impressive facades both to the Circus Maximus and to the Forum Romanum, transforming in their turn the appearance of the city.[70] Given that, and the monumental physical scale of the palaces within the city, it is highly probable that the Palatine Hill, and particularly the constantly evolving facade that faced the Circus Maximus, would have been understood in the ancient world as the monumentalized image-like staging of imperial power (Fig. 8).[71]

3.2 Funerary monumental structures: Size in the landscape (case studies 4, 5)

The display of power and wealth in monumentalized form finds a distinctive expression in funerary structures: in many instances, permanence and timelessness, two of the aspects of manifold monumentality, are grounded in religious beliefs. The phenomena in the case studies presented in this section arose in societies whose circumstances differed fundamentally from those of the early state in the Near East (4th – 3rd millennium BC) or imperial Rome (1st – 3rd century AD). In case study 4, the funerary monumentality of the King's Grave of Seddin is an exceptional phenomenon in a chiefdom, and the Skythian-era kurgans in the Eurasian steppes examined in case study 5 are an example of funerary monumentality manifested in a widespread phenomenon associated with a society of mounted nomads

Case study 4: The King's Grave of Seddin

The burial mound known as the 'King's Grave' of Seddin (Fig. 9) is located in the Prignitz district of Brandenburg, an area in which, to date, around 1000 Bronze Age and early Iron Age burial mounds have been discovered at approximately 350 sites. Most of the burial mounds were probably created during the later Bronze Age or early Iron Age, between 1100 and 530/520 BC.[72] Most of the mounds are 10–30 m in diameter and 1.50– 2.50 m in height.

In the period from the 10th to 8th century BC, the area around the middle reaches of the Stepenitz River, in the environs of the present-day town of Seddin, was a center of power

69 See Wulf-Rheidt 2012 for a detailed treatment of this aspect.

70 On the Flavian new construction and extension phases, see Pflug 2013; Wulf-Rheidt and Sojc 2009.

71 On the semiotics of the facades, see Beste, Thaler, and Wulf-Rheidt 2013, 84–91.

72 May and Hauptmann 2012, 94.

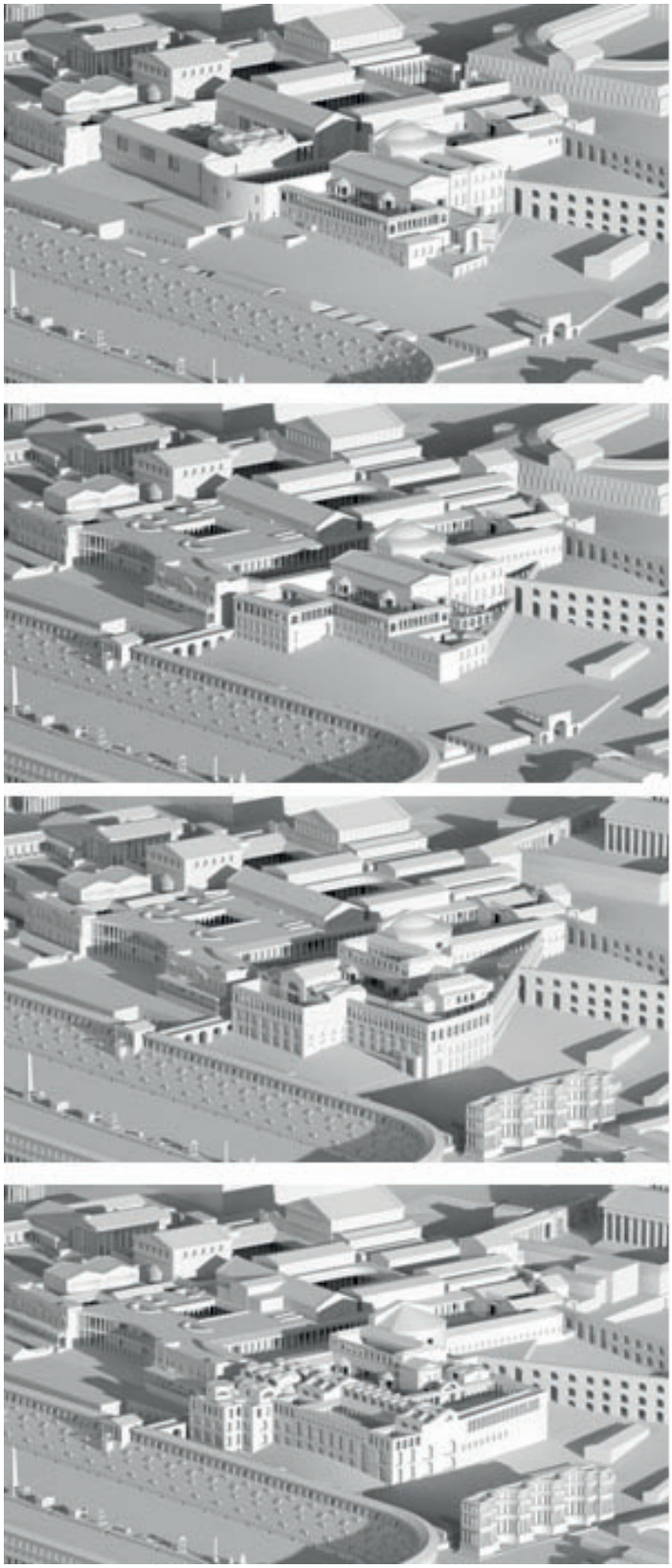

Fig. 8 | The development of the imperial palaces on the Palatine Hill in Rome. Virtual reconstruction models. Flavian (end of the 1st century AD), Trajan/Hadrian (mid-2nd century AD), Severian (beginning of the 3rd century AD), Maxentian (beginning of the 4th century AD).

and wealth of enormous significance. It is here that the greatest numbers of burial mounds in the Prignitz district and the greatest numbers burials containing swords and/or high-

quality bronze vessels in the North have been found.[73] Scholars believe that a chiefdom existed in this area.[74]

The King's Grave of Seddin (Fig. 9) is the clearest manifestation of this accumulation of wealth and power. In the 9th century BC, a 30–40-year-old man, and probably two women as well, was interred in a slab-lined burial chamber plastered in red-painted clay. Above the chamber, a monumental burial mound was constructed. The costs and work involved were extraordinary in every respect. In no prior or subsequent period was a tomb of such immensity constructed in the Prignitz district. The King's Grave is regarded as a prime example of a "splendorous, princely, élite or chieftain tomb" on the threshold of the Iron Age in the North.[75] As we demonstrate below, the King's Grave of Seddin meets all the standards of monumentality proposed by Furholt:[76] the size and visibility of the monument in the landscape, the large expenditure in terms of craftsmanship in its construction, the unique nature of the form and situation in the landscape, and finally, the permanence of the complex.

Part of the burial mound was destroyed as a result of its use as a quarry in the late 19th century. The burial chamber was discovered in September of 1899, and approximately 40 objects were recovered from it.[77] The original height of the mound was probably between 9 and 10 m and the ring of stones (Fig. 12) encircling it is roughly 62 m in diameter. The King's Grave is one of the largest Bronze Age or Hallstatt period burial mounds in central and northern Europe.[78] Standing as the only mound on a plateau, its physical size ensures that it can be seen from afar, from any direction.

At present we are not in a position to quantify the expenditure involved in constructing the burial chamber and burial mound to our satisfaction with respect to either materials or labor. It is obvious, however, that an immense amount of work went into the monument's construction: the ring of stones encircling it covers an area of approximately 3000 m^2, and past estimates place the mound's volume at around 16 000 m^3.[79] In addition to the actual construction work, the supply of building materials and the 'builders' themselves, erecting the object must have required a streamlined organization and a planning process, regardless of whether the burial mound was erected over a short or long period of time. The period involved must have been relatively long though, perhaps

Fig. 9 | Photo of the 'royal tomb' from the west.

73 May and Hauptmann 2011, 136–137.
74 Wüstemann 1974, 95.
75 Hänsel 2003, 61.
76 Furholt 2012, 116.
77 May and Hauptmann 2005, 4–5, fig. 1.
78 Thrane 2013, 329–337.
79 May and Hauptmann 2001, 26.

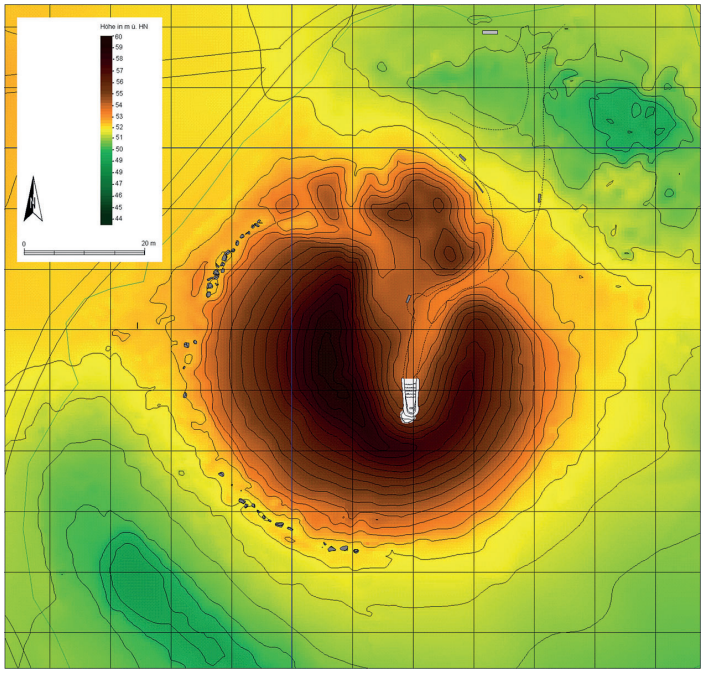

Fig. 10 | Vertical layer plan of the 'royal tomb' with surrounding stone circle and burial chamber (below).

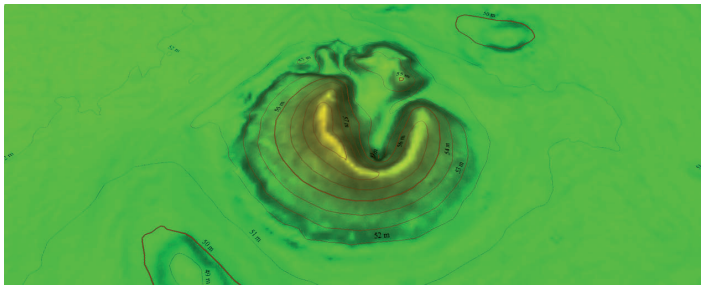

Fig. 11 | Three-dimensional model of the 'royal tomb'.

stretching over years or subject to intermittent interruption, which seems likely to have resulted in to even more challenges and higher costs.

Constructing the polygonal stone chamber with its false vault must have been a particularly challenging task. Only a small number of sites with stone structures of this type have only been found.[80] The Seddin chamber has a diameter of around 2.35 m and an interior height of approximately 1.60 m (Fig. 13). That makes it 2.5–3 times larger by volume than any of the very few other chambers of this construction that have been found. It is the largest Bronze or Iron Age stone structure forming a hollow chamber in Brandenburg, or anywhere in the wider region. It could not have been constructed without the help of experienced specialists. It is not clear where this expertise came from. The extremely large burial chamber is concealed under an immense burial mound. The former is dwarfed by the comparison, since the area of the base of the burial mound is about 700 times larger than the interior area of the chamber (Fig. 14). Archaeological investigations carried out in 2013 determined that the eastern side of the burial mound is made up of individual layers of sand, which were sealed with smaller stones, probably covering their entire surface. It is probable that the Bronze-Age surface of the burial mound had a similar stone covering, creating the impression of an immense stone structure.

80 Krause 1891, 262–276; Götze 1912, 82–89; Breddin 1983, 63.

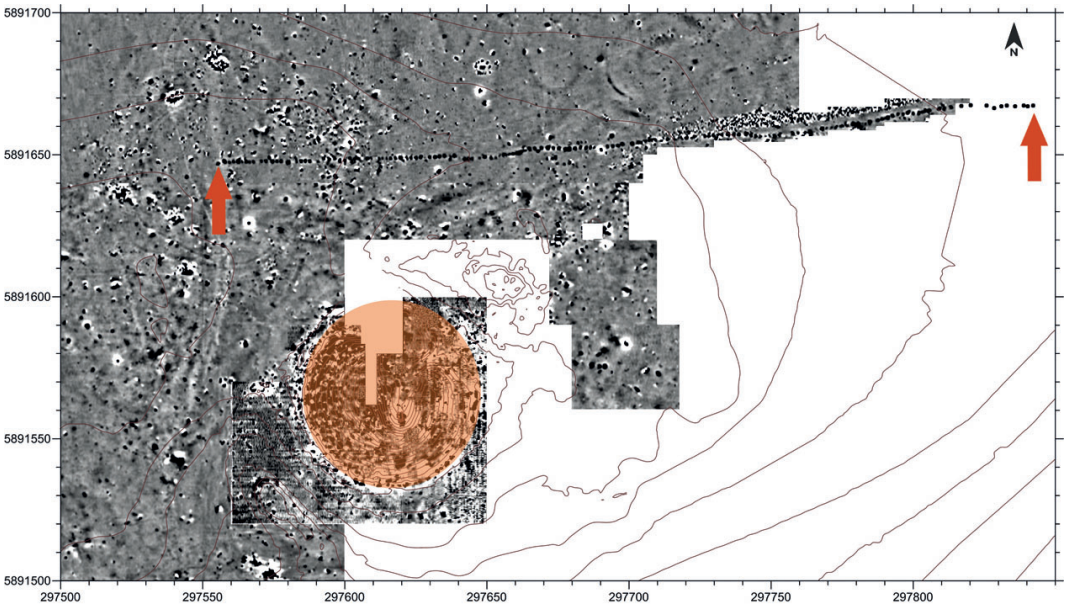

Fig. 12 | Magnetogram of the royal tomb (orange circle) and the row of pits (red arrows).

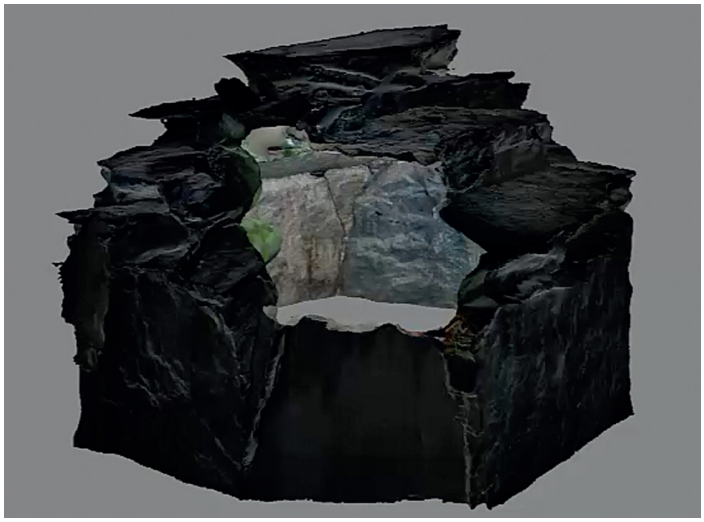

Fig. 13 | Current model of the interior of the burial chamber of the 'royal tomb' – automatic multiple image photogrammetry.

Evidence of a 290-meter long row made up of approximately 150 pits (Fig. 12) was found just 50 m to the north of the burial mound. The pits are round to oval in shape, 0.6–1.0 m in diameter and as deep as 0.8 m. The pits contained partially scorched stones and burnt earth with a small amount of charcoal, but no other contents have been detected. The 'Seddin row' is aligned on a roughly east-west axis.[81] It is possible that it was created at about the same time as the burial mound as its origins probably lie between 950 and 800 BC.[82] Although linearly arranged pits at many sites have been interpreted as cooking pits, this possibility has been discounted in Seddin[83] since analyses indicate that it is improbable that fires ever burned in the Seddin pits. One possibility is that the remains of fires elsewhere were buried and concealed in the pits for ritual purposes. In all probability,

81 Schenk and Goldmann 2004, 57–59.
82 May and Hauptmann 2012, 87.
83 Honeck 2009, 43–45; Schmidt 2012, 37–39; Meier 2013, 228–229.

Fig. 14 | Schematic east-west profile through the royal tomb and the burial chamber (red arrow) – photorealistic laser scan with added graphics.

this phenomenon belongs in the same context, both spatial and ritual/functional, as the burial, thus making the ensemble unique. The row of pits was probably largely invisible as a structure on the upper edge of the site.

Pollen analyses suggest that open grassland existed on a scale unmatched in any other period of prehistory during the golden age of the center around Seddin.[84] Someone standing on the summit of the King's Grave would therefore have been able to see the other burial sites in the vicinity, and this effect must have been in the minds of the burial mound's planners. Otherwise, the monumentality on display at the King's Grave would have served no purpose. The closest burial mounds are 500 to 900 m away. About one kilometer to the north is a contemporaneous cemetery (group of burial mounds). Further to the north, cemeteries are spaced at regular intervals like beads on a string. Approximately one kilometer to the south-east of the King's Grave is another large cemetery (Fig. 15). Due to the morphology of the landscape, visual contact between the two cemeteries closest to the King's Grave would have been impossible. However, it certainly must have been possible to see both from the King's Grave. This free-standing burial mound probably comprised a monumental link in a 'chain' of cemeteries. If this is the case, then the deliberate choice to site the tomb in a position of prominence within the surrounding space must be understood as comprising an important feature of monumentalization.

Having stood for three thousand years, the King's Grave in Seddin has adequately demonstrated its permanence, despite major encroachments during its use as stone quarry in the 19th century. Certainly, this endurance can be put down to a large extent to the sheer size of the mound, but its internal structure also played a role, probably consisting of alternating layers of sand and stone, further secured by a ring of stones and an outer stone shell.

Case study 5: Large kurgans of the Scythian era – Early mounted-nomad ritual as architecture[85]

When the use of horses as saddle animals began to take off at the beginning of the 1st millennium BC in Inner Asia (southern Siberia and the northern regions of China), causing the people living in those regions to adopt a far more mobile way of life, the level of communication grew considerably. Increased mobility brought with it the exchange of both materials and ideas. In the 9th/8th century BC a temporary period of aridization in the Eurasian steppe and the increasing use of iron[86] resulted in a new mode of life and subsistence, in which a highly mobile form of pastoralism took on a leading role. In the period from the 8th to the 3rd century BC, a huge swathe of Eurasia, from the Yenisei in southern Siberia to the central Danube in eastern central Europe, was inhabited by groups characterized by mounted nomadism. These groups shared a similar lifestyle and economy and held comparable religious beliefs. Another commonality was the extraordinary social importance of their leading élites, which is reflected in monumental burial sites and the

84 Conveyed verbally, S. Jahns, BLDAM, March 2014.

85 Our warm thanks go to Dr. Sergei Polin (Kiev, Ukraine) for an exciting discussion and valuable information.

86 Parzinger 2006, 541; Попов 2006, 17; ref. Nagler 1996, 3–4.

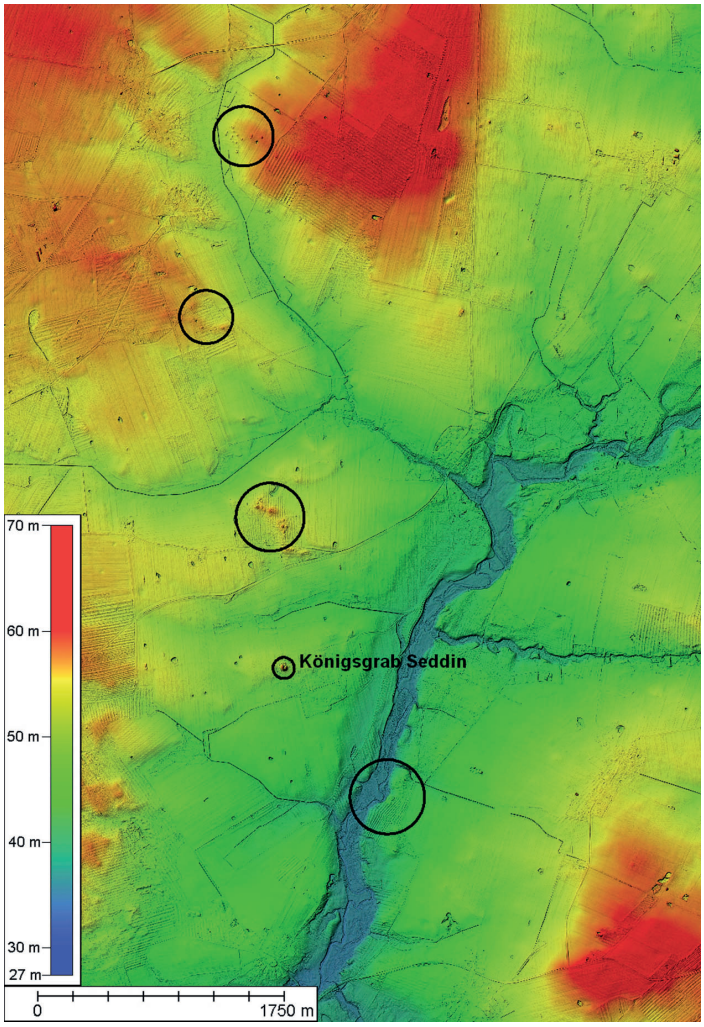

Fig. 15 | Distribution of burial mound fields (larger black circles) and position of the royal tomb (small black circle) in the Seddin core zone.

costly grave goods. Wherever these features are found, we speak of a Scythian cultural group.[87]

An enormous amount of knowledge about building materials, building planning and building logistics was required for the construction of this type of large-scale tomb for mounted nomadic élites. These tombs, known as 'kurgans',[88] were not created simply by heaping up a pile of earth; they were constructed according to a specific plan as a ritual transposed into architecture. At over 10 m high and more than 200 m in diameter, some of the kurgans are visible for great distances across the flat landscape of the steppe. For that reason, these particular kurgans are regarded as monumental burial sites.[89]

Until well into the 1950s, the excavators who worked on large kurgans focused solely on the burials and grave goods they contained. Scholars evinced little interest in the structure of the kurgans, regarding them as merely a heap of earth, unworthy of any particular attention.[90] The 1954 excavation of a large kurgan of Melitopol (Ukraine) was an exception. The excavator in question, A.I. Terenozhkin, noticed that various colors in the profiles of the mound, which led to the recognition that they should be interpreted

87 Parzinger 2013, 539–540.
88 'Kurgan' is an old Turkic name for a mound or burial mound (acc. to Радлов 1893, 570, 920, 940).
89 Gass 2011a, 65–67.
90 Полин 2011, 208–211.

as clay blocks or pieces of sod. Accompanying that realization came the recognition that the kurgan was not just a heap of earth, but a carefully constructed structure.[91]

Another milestone in the understanding of Scythian-era large kurgans came with the investigation of the large-scale kurgan of Baikara in northern Kazakhstan (height 7 m; diameter 85 m). The publication of those excavations in 2003 led to a fundamental shift in the way scholars understood kurgan structures.[92] They became aware that the structures could provide an enormous amount of information about the rituals that had taken place there.[93] The core of the mound in Baikara was made up of blocks of turf, roughly rectangular in form, and fairly comparable in size (0.3–0.7 x 0.3–0.4 m). Once dry, the blocks exhibited a variety of colorations, ranging from light brown to deep black; in some places, a white powder from the decayed grass was detected on their upper edges (Fig. 16). Pieces of sod were used to construct the kurgan analogously to dried clay bricks. This observation contributed to the realization that the kurgan structure can be understood as a form of architecture.[94] Evidence of a similar use of sod blocks has been found in the Scythian-era large kurgan (height 9 m; with a square base of 75–77 m on each side) of Barsuchii Log (Khakassia), which belonged to the southern Siberian Tagar culture (Saragash Period, 5th – 3rd century BC). The sod and the clay blocks suggest (reveal?) the existence of a linear structure in the kurgan's construction.[95] Building techniques of this sort were used throughout the Eurasian steppe during the 5th – 4th century BC, as comparable finds from eastern Kazakhstan (kurgans of Chilikty), the southern Urals (kurgans of Filippovka), Ukraine (the kurgans of Babina Mogila, Chertomlyk) and the north Caucasus (kurgans of Kelermes) have shown.[96]

Fig. 16 | Grass sod structure and clay packing of the Baikara large kurgan. Western section of profile 3A. View from the north-west.

Variations should be interpreted locally specific features. For instance, the site that would become the entire interior area of the kurgan of Baikara was covered with birch bark before the kurgan was built. This covering had at least two effects: a whitish-yellow coloration, and the protection of the kurgan's substructure from humidity and decay.[97] Birch bark was also used in the large kurgans of Khakassia (southern Siberia). For instance,

91 Тереножкин and Мозолевский 1988, 19.
92 Parzinger, Zajbert, et al. 2003.
93 Мозолевский and Полин 2005, 241–252, 264–265; Gass 2011b, 215–216, 224.
94 Parzinger, Zajbert, et al. 2003, 50–51.
95 Parzinger, Nagler, and Gotlib 2010, 181, fig. 17–25.
96 Nagler 2013, 610.
97 Parzinger, Zajbert, et al. 2003, 42–44, fig. 43–44, appendices 1–6.

in the kurgan of Barsuchii Log, multiple layers of birch bark, in some cases reaching an aggregate thickness of 5–8 cm, were wound around each of the larch beams used in the dromos and the burial pit, forming an insulating layer (Fig. 17).

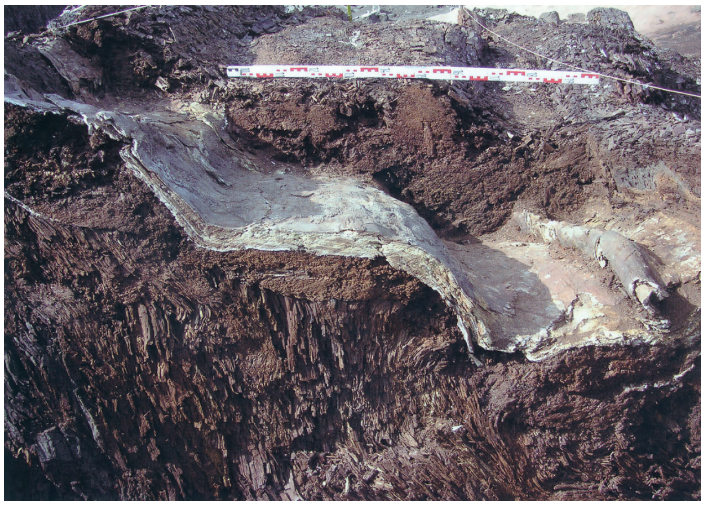

Fig. 17 | Barsuchii Log kurgan. Birch bark layers on the domos covering.

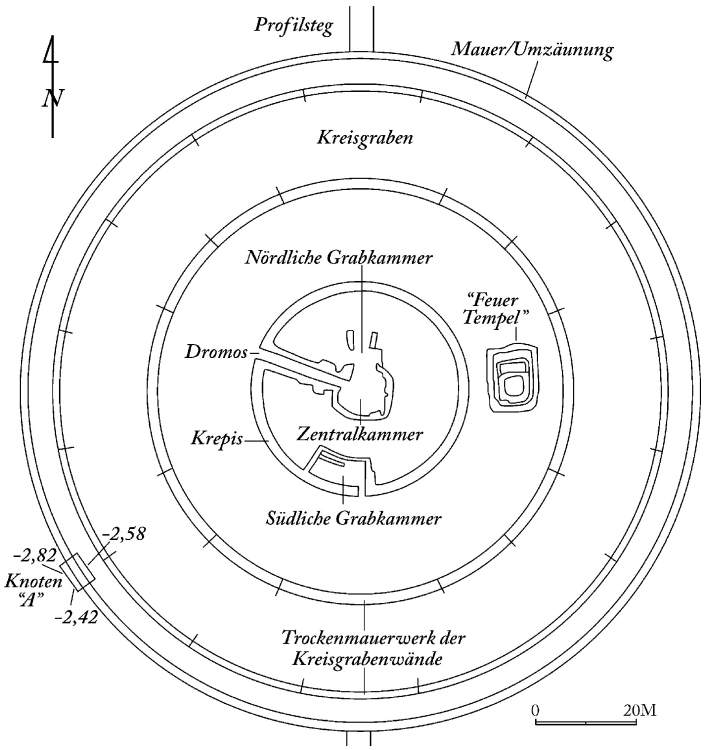

Fig. 18 | Sketch of the Krasnoye Znamya kurgan.

Some of the large kurgans from the Tagar era have an unusual pyramid-like shape featuring rectangular stone facade with a megalithic appearance. It is highly probable that the origins of this structural form, which is characteristic only for the central Yenisei region,

lie in the local Bronze Age cultures.[98] The stone facade was made up of stone slabs stacked in layers in dry-stone construction. The outer side of the facade consisted of enormous, vertically arranged steles spaced at irregular intervals.[99] In the case of the Salbyk kurgan, these steles were 4–5 m high and weighed 30–40 metric tons.[100]

Stone played a major role as a building material for the large kurgans in the northern Caucasus. In the case of the kurgan of Krasnoye Znamya (height approx. 11 m; diameter 71 m), for instance, the section of the kurgan built above ground consisted of multiple consecutive layers of black earth, stone and reeds, which were then covered by a protective stone shell. Below the mound, excavators uncovered multiple different structures (Fig. 18), which had been erected at ancient walking level: a stone krepis wall (diameter just under 42 m; width 0.75 m; height approx. 1.5 m) with four wattle fences and three burial chambers, as well as a dromos that led to the central chamber (length 18 m; width 1.5 m). A circular enclosure (27.6 m wide and up to 3.2 deep) surrounded the mound. The spoil from the enclosure was used in the kurgan's construction. Both the inner and outer sides of the circular enclosure were reinforced with a dry-stone wall made of stone slabs. Finally, another wall was erected about 4.5 m beyond the circular enclosure, encircling an area with a diameter of 140 m. This kurgan has been dated to the 7th – 6th century BC.[101]

3.3 Large technical infrastructure systems (case study 6)

Ancient cities were not made up only of the structures that meet the eye, which are generally perceived as architectural monuments: far greater resources were expended on their physical infrastructure.[102] Several of the monumental structures in Resafa, the pilgrimage city on the edge of the Syrian semi-desert, are neither representative nor sacred buildings but serve instead a more basic purpose, the supply of water. Due to their XXL size, they are not purely infrastructural structures, but large technical infrastructure systems.[103]

Case study 6: The water supply system of Resafa

Resafa-Sergiupolis, set in an inhospitable region at the site of a limes fort, 25 km south of the Euphrates arose in the period between the mid 5th and very early the 6th century AD. An important pilgrimage site,[104] it attracted huge crowds of first Christian, and later Muslim pilgrims.[105] Environmental conditions in the Resafa area made it a poor choice as the site of a large city. The area has an average annual rainfall of only around 150 mm, minimum annual rainfall is 100 mm.[106] Resafa had no natural source of potable water; at best, there were a few wells with brackish water, rendered unsuitable for drinking by the area's gypsiferous soils. The site does have one potentially useful feature though, a natural depression that accumulates water on a seasonal basis.[107]

Several primary sources describe the city as impressive in appearance, and its wall, which still towers above the site at heights up to 15 m,[108] enclosed an area of 210 000 m^2.[109]

98 Nagler 2013, 613; ref. Parzinger and Nagler 2007, 62–65.
99 Parzinger, Nagler, and Gotlib 2010, 216–233, fig. 16, 97–132.
100 Parzinger, Nagler, and Gotlib 2010, 255, fig. 142–147.
101 Петренко 2006, 18–34, 108; tab. 2–20.
102 On the term 'infrastructure' see van Laak 1999, esp. 290-292; concerning the efforts for water storage on an urban scale see Ohlig 2007.
103 On large technical systems see Joergens 1988, 9–36.
104 Ulbert 2008; Brands 2002, esp. 212–235; see also Konrad 1992, 313–402.
105 See Fowden 1999; Sack, Gussone, and Kurapkat 2014, 257–274; Sack 2014.
106 Wirth 1971, 88 –93; Berking, Beckers, and Schütt 2010, 819 –820; see also Sack and Gussone 2011, 58–65.
107 Wirth 1971, 150. 442; ref. Garbrecht 1991, 239.
108 Karnapp 1976, 1. The city wall (according to Karnapp 1976, 8) measures 350–411 x 536–549 m.
109 Karnapp 1976, 8–9; Garbrecht 1991, 239; see also Hof 2016.

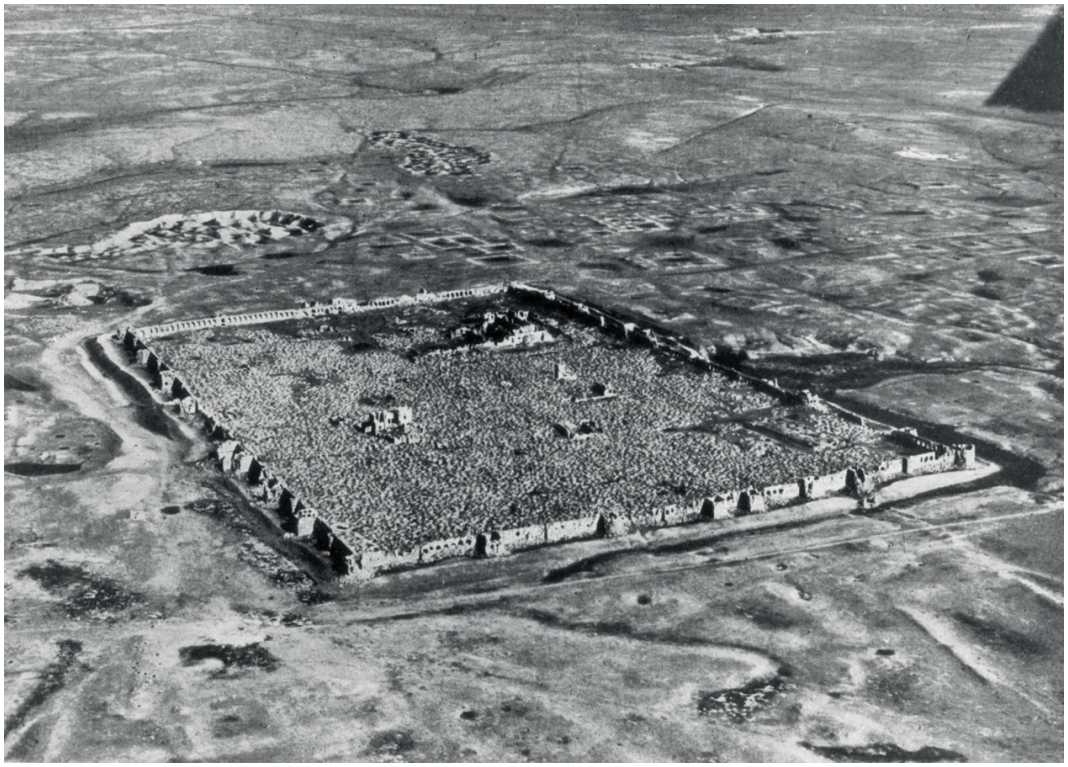

Fig. 19 | Resafa, aerial image from the north-west.

The impression of monumentality is underlined by Resafa's position on the crest of the bank (approx. 6 m high) of a wadi, which runs along a tectonic fault line[110] (Fig. 19). In addition to the city wall and the five large churches in the city that were certainly perceived to be 'large-scale construction projects' at the time of their construction,[111] the city's complement of monumental structures included four large cisterns, which have been characterized as 'masterpieces of late Roman engineering'[112] (Fig. 20).

How, though, was this city supplied with water, that most basic of necessities?
The first systematic investigation of Resafa's water supply systems, with their monumental cisterns and the inflows that fed those reservoirs, were conducted by Günther Garbrecht and Werner Brinker.[113] However, there were no definitive answers to the questions of where water came from and in what quantities and at what intervals it could be used for the city's water supply (Fig. 21 and Fig. 22) until Brian Beckers conducted his study of the surrounding region with a view to the water supply as part of his dissertation work, which was funded by Topoi.[114]
The four large cistern complexes, which still stand today, provide the starting point for considerations about the infrastructure projects. These cisterns are monumental structures, mostly subsurface, of differing sizes and structural types. Three of the large cisterns stand adjacent to each other in the south-west of the city. They are known as the domed

110 Ref. Beckers, Berking, and Schütt 2012/2013, esp. 32.
111 Hof 2013, 33.
112 Wirth 1971, 150.
113 Garbrecht 1991, 239; see also Brinker and Garbrecht 2007. During its florescence, the city had a population of between 5000 and 10 000, including soldiers stationed there and temporary visitors, e.g. travelling merchants and pilgrims. The first mention of the monumental water supply facilities was already made by the first scholars to visit Resafa, Spanner and Guyer 1926, 45–47. Plate 1; Musil 1928, 161, fig. 91.
114 Beckers, Berking, and Schütt 2012; Beckers 2013; Beckers and Schütt 2013; Beckers, Berking, and Schütt 2012/2013.

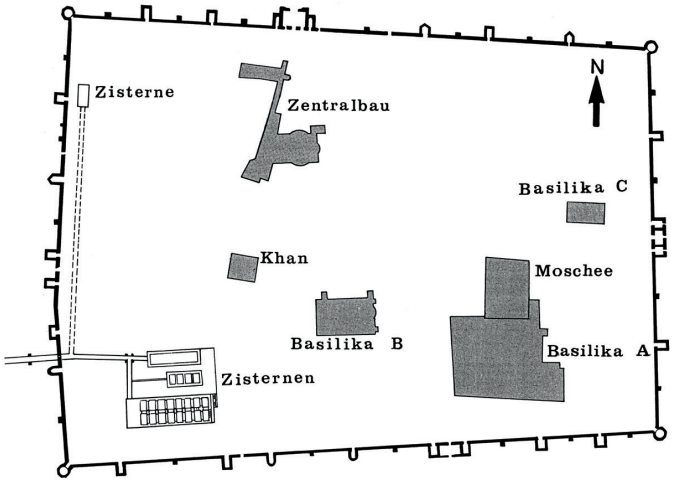

Fig. 20 | Resafa, location of the cisterns in the city.

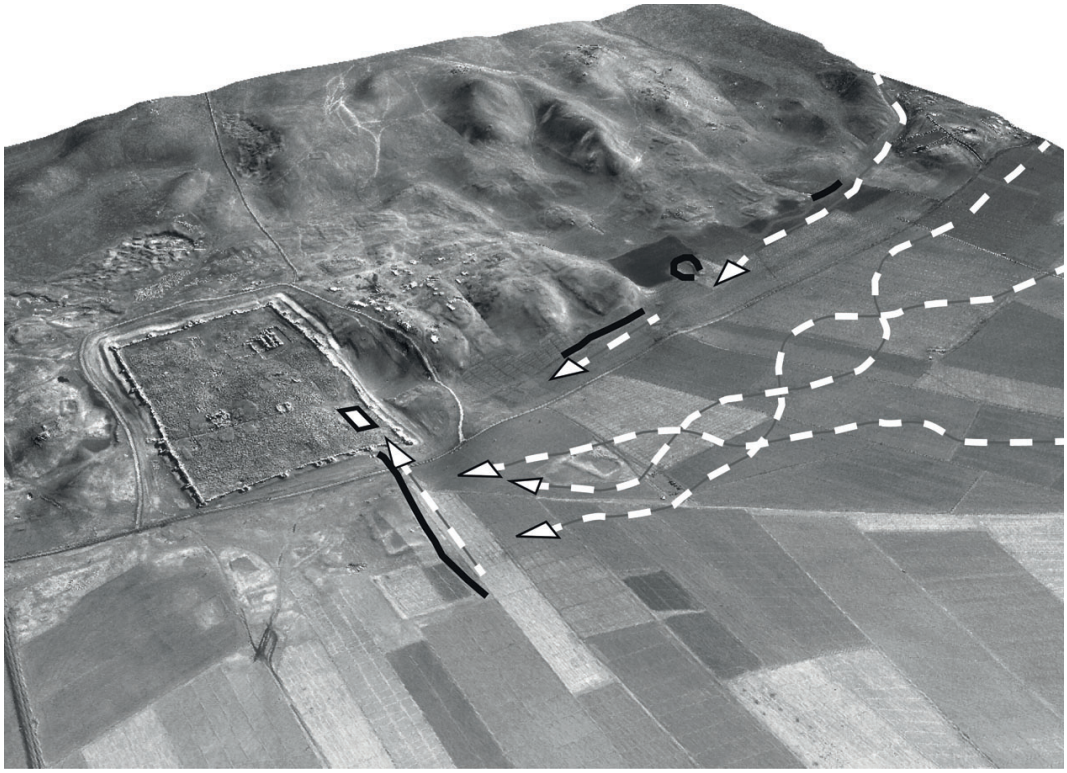

Fig. 21 | Resafa, water runoff in the wadi and inflow.

cistern, the small cistern and the double cistern – or the great cistern. The fourth cistern, also a 'small' cistern, stands in the north-western corner just inside the city wall. All four cisterns were supplied through a single, interconnected system of channels, which came from the west, entering the city through openings in the wall and then fed into the cisterns.[115] (Fig. 23).

The water itself was runoff from the heavy spring rains. A dam retained water flowing toward the city wall from the west and directed it through a monumental 'water gate'. A sediment basin was constructed on the western side of the water gate (Fig. 24). Thus

115 Brinker 1991, 137–141; Garbrecht 1991, 241–245; see also Brinker and Garbrecht 2007.

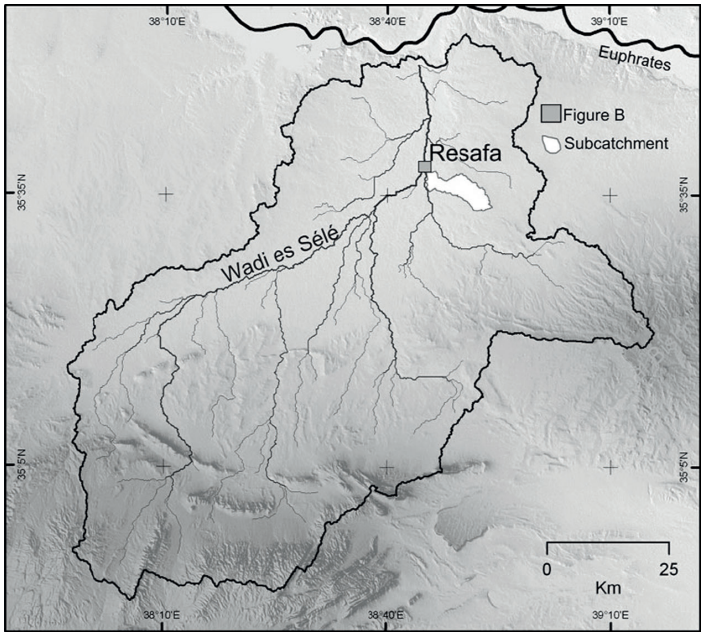

Fig. 22 | Resafa, catchment area of the Resafa basin with potential water system network.

purified, the water was conducted through inlets built into the city wall, which were initially large but were reduced in size[116] shortly after their initial construction was complete. The inlets led to the cistern inside the city wall, which was the connection point for the water distribution system within the city.

In addition to the large cisterns, which were built specifically for the water engineering system, there is evidence that small pear- or bottle-shaped cisterns (not connected to the system) were also used in the city. These had a capacity of around 20–30 m^3, which corresponds to a year's supply of drinking water for a family of six. The wells mentioned above can also be detected in the fabric of the city, however the brackish water they provided would have been suitable only for cleaning purposes. To date, 27 small cisterns and 12 wells have been identified in the city, which is buried under large amounts of rubble.[117] (Fig. 25 and Fig. 26).

116 Hof 2010, esp. 242–244.
117 Brinker 1991, 124.

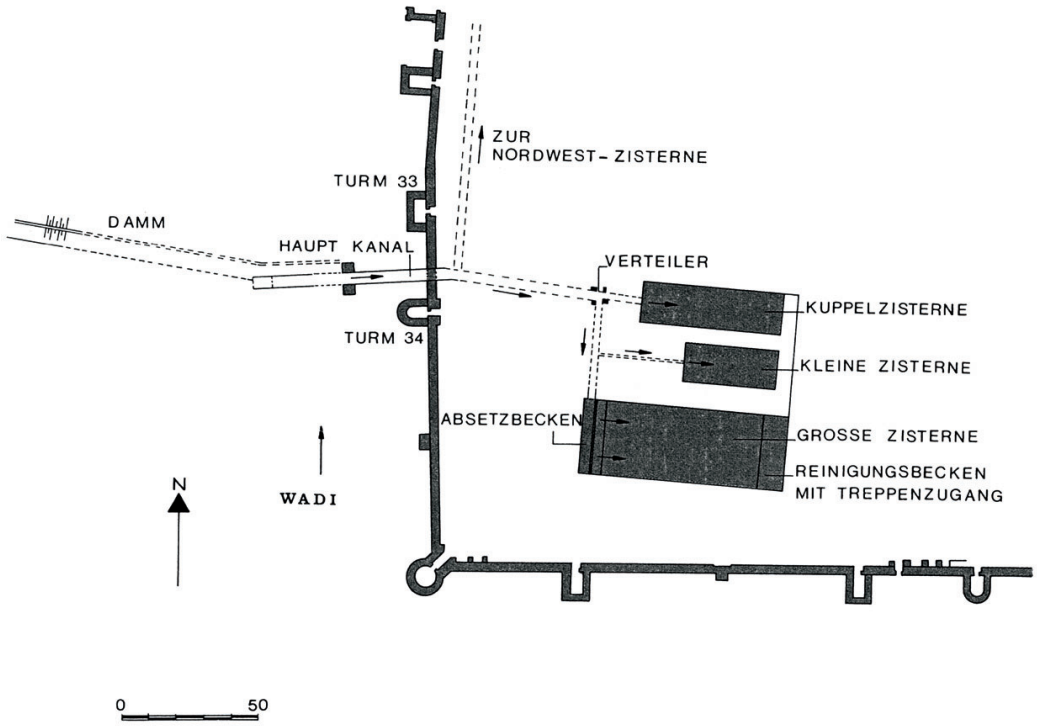

Fig. 23 | Resafa, water supply system in the south-west of the city.

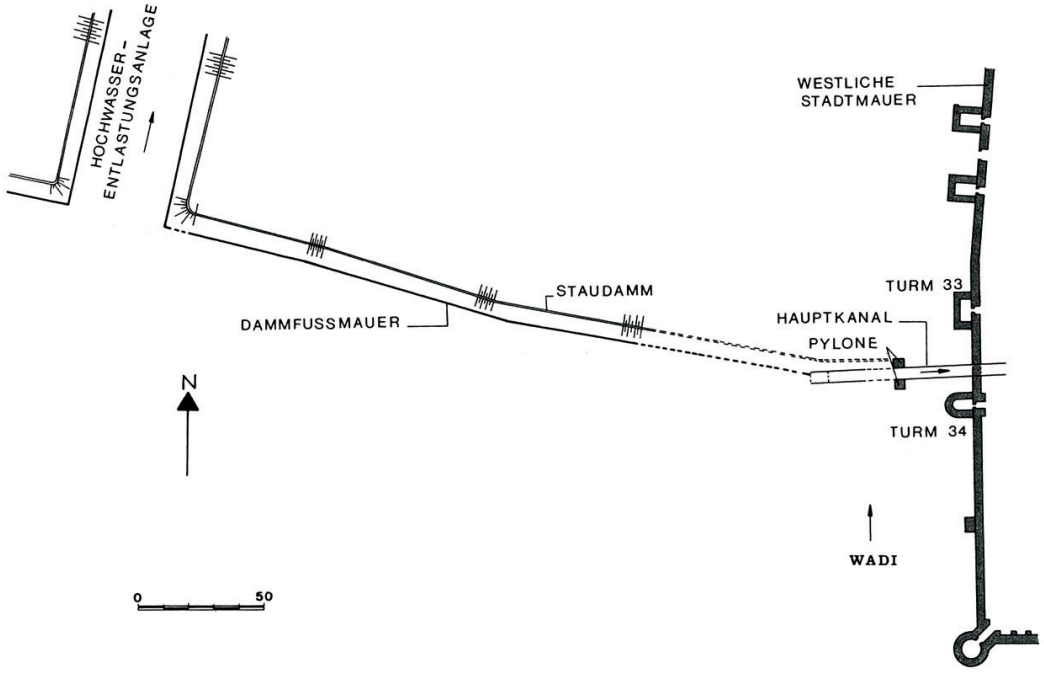

Fig. 24 | Resafa, dam and inflow on the western side of the city.

Fig. 25 | Large cistern, view to the east.

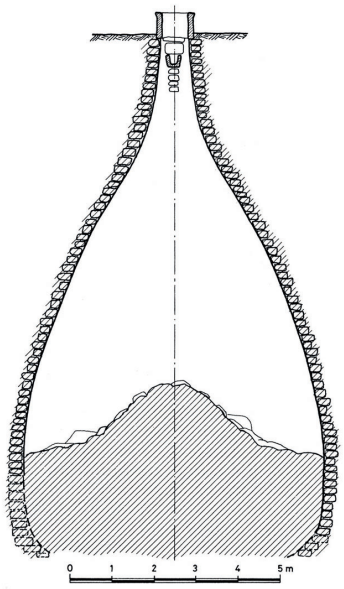

Fig. 26 | Bottle-shaped small cistern.

Investigations by Stephan Westphalen and Peter Knötzele[118] have shown that the domed cistern[119] and the small cistern[120] adjacent to it were built in quick succession during an initial phase of construction – probably in the early 6th century AD. The large double cistern[121] and the northern cistern[122] were not erected until later in that century. According

118 Westphalen and Knötzele 2004, 346–347.
119 Domed cistern: volume 3400 m^3, dimensions: 40.40 x 9.35 m, height up to water inflow: 8.90 m.
120 Small cistern: volume 2050 m^3, dimensions: 26.8 x 24 m, height up to water inflow: 8.72 m.
121 Double cistern/large cistern: volume 14 600 m^3, dimensions 64.3 x 21.77 m, height up to water inflow: approx. 10 m.
122 North-western cistern: volume 770 m^3, dimensions: 15.80 x 6.65 m, height up to water inflow: 6.80 m.

to the calculations performed by Brinker and Garbrecht, the large cisterns alone could provide the city with 20 777 m^3 of drinking water.[123]
The large cistern, or double cistern, appears to have remained in use until the city's demise (c. 1269): the imposing and fascinating structure exhibits indications of multiple construction phases, which can be associated with activities during the 6th/7th century and the 2nd quarter of the 8th century. Ceramic finds uncovered during the excavation of the water distribution system[124] indicate that maintenance work continued to be carried out right up to the time of the city's abandonment, with the latest maintenance work dated by a coin from 1236.[125] The monumentality of the double cistern, as well as of that of the adjacent complexes of the cupola and small cistern, can still be perceived today.

Written sources contain only relatively brief descriptions of the buildings in Resafa. It is therefore noteworthy that the city's water supply system is mentioned regularly, which is probably explained by Resafa's position "in a desert without water".[126] Written sources generally identify the rulers as being the initiators or as responsible for the water supply system construction projects, which underlines the significance and representative nature of these infrastructure projects. This applies to both the Byzantine rulers, like Justinian I (rgn. 527–565),[127] and the Arab federates such as the Ghassanids/Jafnid an-Numan b. al-Harit b. al-Aiham.[128] The Umayyad caliph Hisham b. Abd al-Malik (reign 724–743) is also recorded as having initiated construction and repair works on the city wall and to the water supply.[129] The fact that the water supply system does not consist only of large cisterns in the city, but also incorporates the surrounding area[130] testifies to the large spatial scale of the projects as well.

4 Preliminary results, perspectives, questions

As we use the term, 'XXL projects' describes projects that involve disproportionate levels of investment, risk, spatial impact and relevance to the society as a whole, irrespective of temporal, spatial or culturally specific variations. Therefore field of inquiry into XXL projects is very broad, encompassing a number of systematic approaches and posing unusual methodological challenges.

In the ancient world, the phenomenon of XXL projects as such was conceptualized with the terms 'thaumasta' or 'mirabilia', on the basis of a limited number of examples. Only a few of those examples, famous in their own time and in the post-classical era, are still in existence; many of them are known to us only through descriptions or depictions in the historical record. For all their differences, they are all, in essence, great works of architecture or art, profane or sacred in nature. The list of ancient XXL projects is actually

123 In calculating the volumes of the cisterns used as to store drinking water, the decisive factor is the distance between the floor of the cisterns and the level of the crossbar of the barrel vault, since this point corresponds to the position of the filling pipe and thus indicates the maximum height of the inflow.
124 Logar 1991.
125 Brinker 1991, 146.
126 Ibn as-Sihna, quoted from Kellner-Heinkele 1996, 153.
127 Procopius, de Aedificiis II, 9, quoted from Procopius et al. 1954, 157: "He stored up a great quantity of water and thus provided the inhabitants with a bountiful supply".
128 Yakut, quoted from Kellner-Heinkele 1996, 146; the identity of the ruler is not made unequivocally clear, see Kellner-Heinkele 1996, 146, note 114. Yakut claims for this ruler that he "had the cisterns of Resafa renovated and the most impressive of its cisterns built." For the differentiation between the tribe (Ghassanids) and the Jafnids (dynasty) see Fisher 2011, 3–7.
129 Ibn Saddad quoted from Kellner-Heinkele 1996, 151, "Hisham b. Abd al-Malik b. Marwan built [ar-Rusafa]. [The city] has walls made of stone and a large cistern for rainwater in its interior, from which the inhabitants drink."
130 As is already stated in the written sources: anonymous source, quoted from Kellner-Heinkele 1996, 154, "Cisterns were set up for them and a route [for transporting] the water from the other end of the desert."

far longer than the canon of wonders of the world suggests: there were many works comparable in type and ambition in the ancient world that never found their way into those catalogs. There were a variety of reasons for those omissions. The earliest lists of wonders of the world are known to have been compiled in the late Hellenistic period. The entries on those lists and their subsequent amendments reflect the interests of those who compiled them, or of those who commissioned them. At least in the earliest lists, the selection criteria exhibit a clear bias towards common ancient itineraries, and the lists were never intended to serve as encyclopedic inventories. Not surprisingly, the concentration on *mirabilia* in the eastern Mediterranean region and the Near East from the late 3rd century BC onwards also contributed to the omission of important cultural areas in the ancient world, to say nothing of other limiting parameters, such as the typology of projects included.

The aim of our research group in its initial stages was to place a modern concept of monumentality alongside this antique approach, in order to permit a comparative cultural investigation of monumentality's social function. The primary emphasis in that investigation is on quantifiable aspects. The analysis of the investment in logistics and labor, and in particular of the costs and their relation to the total agricultural/economic total output of the Sumerian state, shows that the building of a ziggurat and the entire sacred infrastructure associated with it was comparatively 'cheap,' and did not place a significant burden on the state's economy. Such complexes, therefore, are not monumental *in this respect*. The monumentality of as feats of construction stems from their sheer size and central (or center-building) position in relation to their architectural surroundings.

Other aspects come to the fore in the case of the imperial palace complex on the Palatine Hill in Rome. Monumentality there is manifest in the immense area that the palace complex claimed for itself within the crowded city, but also in the dominating effect within the urban context of the equaling imposing height of the structural complex, which towers over the city, and in the sumptuousness of the appointments in its interiors. The logistical feats involved in construction of the complex, the increasing monopolization in the production and supply of building materials, such as the bricks needed to build the walls, and, of course, the mobilization of an enormous workforce: these are dimensions of monumentality which no longer meet the eye, but would have engendered awe and admiration in the ancient world. The immense construction project would have made itself seen and felt not only in the growing dimensions of the buildings taking shape on the Palatine Hill, but also in the thousands of materiel-laden ships sailing up and down the Tiber and the endless procession of carts snaking through the already densely built city to bring supplies to the construction site. Economically, such large-scale projects would certainly have represented an engine for growth in the construction industry. It is quite likely therefore that they held considerable propaganda value for the imperial dynasty and would have had a stabilizing effect on the structure of Roman society. Thus, in this example we can detect another dimension of monumentality our research must assess: that of the 'work in progress.'

The King's Grave in Seddin adds another dimension to monumentality: here, both 'overt' and 'covert' forms can be perceived. The enormous burial mound exhibits its monumentality both to those in its immediate vicinity and far beyond, through its visual impact over an area extending as far as the eye can see. 'Covert monumentality' can only be discovered by taking a 'closer look.' The structure concerned here is the stone burial chamber. After being built, presumably by a relatively small group of people, the chamber was concealed under the gigantic burial mound. This means that knowledge of its imperturbable grandeur would have been passed along mainly by word of mouth. Concealed as it was, its size could not be verified by personal observation. Thus unhindered, it might well have grown beyond measure. Something similar may have occurred with the 290 m-long row of pits. It was probably designed as a spatially expansive and continuously

growing geometric object; it existed in its totality, however, only in the minds of the people who knew about it. Should evidence come to light to confirm the indications suggesting some form of larger spatial structuring in the Seddin area, then there were even more covert aspects of monumentality involved as well. If the King's Grave, the sole large-scale burial mound in an area stretching further than the eye could see, indeed took on the position in space and ritual-functional significance of an entire cemetery that would be monumental indeed.

Ritual was eternalized as architecture in the early Iron Age large kurgans of the warlike mounted nomads in the Scythian cultural group. These kurgans have dominated the Eurasian steppe landscape for 2500 years. The complexes should be classified as monumental large-scale structures built by nomads on the basis of the huge amount of work entailed in their construction[131] and their considerable size. All of the examples underline the enormous amounts of work required in advance of (acquisition of materials) and during construction of the large kurgans of the Scythians.

A third group of monumental projects comes into focus in the area of large technical infrastructure. These are projects designed to supply the demand for basic necessities. The monumentality of the city of Resafa and its water supply system arises from the combination of the system's specific, quantitative size and city's remote location. The amount of work invested in building the system and maintaining its monumental cisterns was great enough to justify the assumption that it involved central planning and higher-level organizational structures. Each new cistern built was larger than the previous one, and there is evidence that they were maintained and kept in repair for as long as the city was inhabited. This indicates a continuing transfer of engineering knowledge and construction experience uninterrupted by multiple changes in the system of rule, and testifies to the vital importance of the water supply for the pilgrimage city and caliphal residence in the semi-arid desert steppe.

XXL projects are exceptional in the ways in which they occupy, shape and control space through monumental interventions in natural or cultural landscapes. The relationships between these projects and the forms of states and societies within which they took shape are distinctive, particularly with respect to the organization they entailed. Based on examples representing a wide range of XXL projects, our research group is investigating the socio-economic environments of such projects, as well as incentives created by their success – or their failure. Another focus in our investigation has to do with the processes of transformation in space that are, to some extent, subject to active control in XXL projects. These processes can act as powerful catalysts for the creation or advancement of knowledge in a wide variety of fields: this too is coming under study. Our research group intends to build on the systematic approaches presented here to pursue these inquiries further.

131 Грязнов 1950, 13–15, 68; Мозолевський 1979, 167; Rolle, Murzin, and Alekseev 1998, 60–64; Мозолевский and Полин 2005, 252–258, 270–272.

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