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On the relationship between hydrogeography and the fortification at the *oppidum* of Manching (Bavaria)

Thimo Jacob Brestel

Introduction

The distinctiveness of Late Iron Age fortifications lies in the fact that they were built at enormous effort, transforming the previous topography of their sites. One of the most impressive examples is the *oppidum* of Manching in the district of Paffenhofen an der Ilm in southwest Germany. This urban settlement is located in the Ingolstadt basin of the River Danube.

The Danube, one of the most important trade routes of the period, was of critical importance during the 300-year long history of the settlement (Sievers 1999, p. 5). The settlement was established as early as the LT B2 phase. In the middle La Tène period, Manching developed from a minor settlement into an urban centre and the population grew steadily. At the end of LT C2, the 380-ha settlement area was surrounded by a 7-km long rampart circuit. The erection of this wall had a massive impact on the landscape. Several waterways were redirected to fit the plan of the *oppidum* and the circuit of the rampart, thereby transforming the hydrogeography of the area. In this paper the author focusses on the interrelationships between the hydrogeography and the fortification, bringing together results from the last two decades of research in Manching.

Hydrogeography

Today the site of Manching is situated on a low-lying gravel terrace, approximately 10 km south of the present-day course of the river Danube (Brunnacker 1970, p. 17-18; Trappe 2013, p. 5). In the La Tène period however the course of the Danube was closer to the settlement. Its inhabitants had direct access to the river by means of a cut-off meander, the 'Altach' or 'Dürre Au' (fig. 1), which formed a natural harbour in the northern part of the *oppidum* but has dried out entirely today. Initially, research was unable to conclude whether the genesis of the cut-off meander predated the La Tène settlement (Thiemeyer 1991) or whether it was of medieval date (Schramedei, Brunnacker 1992, p. 427). To clarify this a large number of soil probes was taken from the 'Dürre Au' area. In the aggradation sediments encountered there, charcoal samples for radiocarbon dating were identified. They proved that the 'Dürre Au' was formed ca. 520–256 BC, when the alluvial fan of the river Paar cut off this meander of the Danube (forming what is sometimes termed a 'chute cut off', see fig. 1) (Leopold, Völkel 2013, p. 9-10). The 'Dürre Au' contained water during the La Tène period and had a direct access to the Danube itself (Völkel, Weber 2000, p. 388; Völkel, Leopold 2007, p. 25). With a depth of several meters, it formed an ideal natural harbour (Völkel, Weber 2000, p. 390) and might have

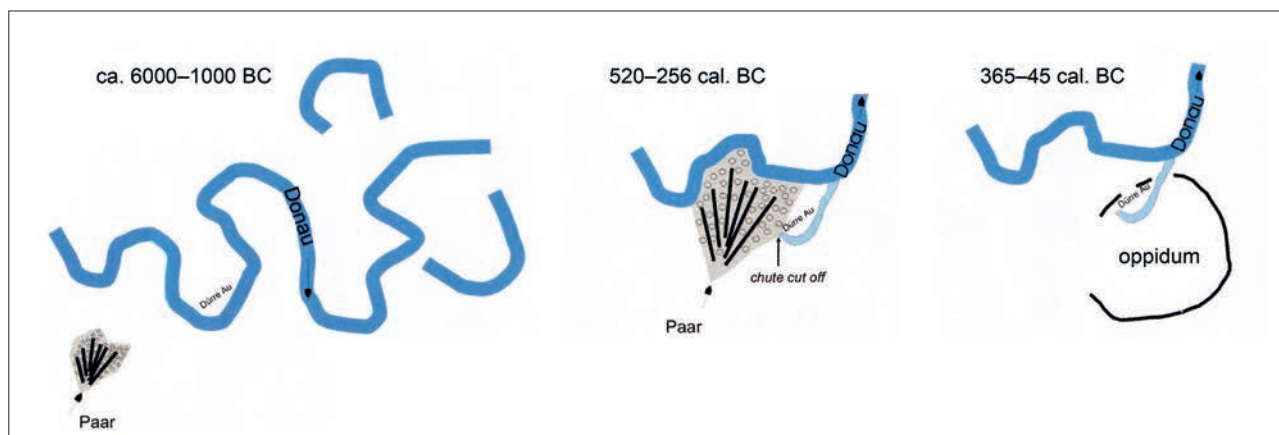


Fig. 1. Model of the formation of the cut-off meander "Dürre Au" at Manching (image: Leopold, Völkel 2013, p. 10 fig. 1).

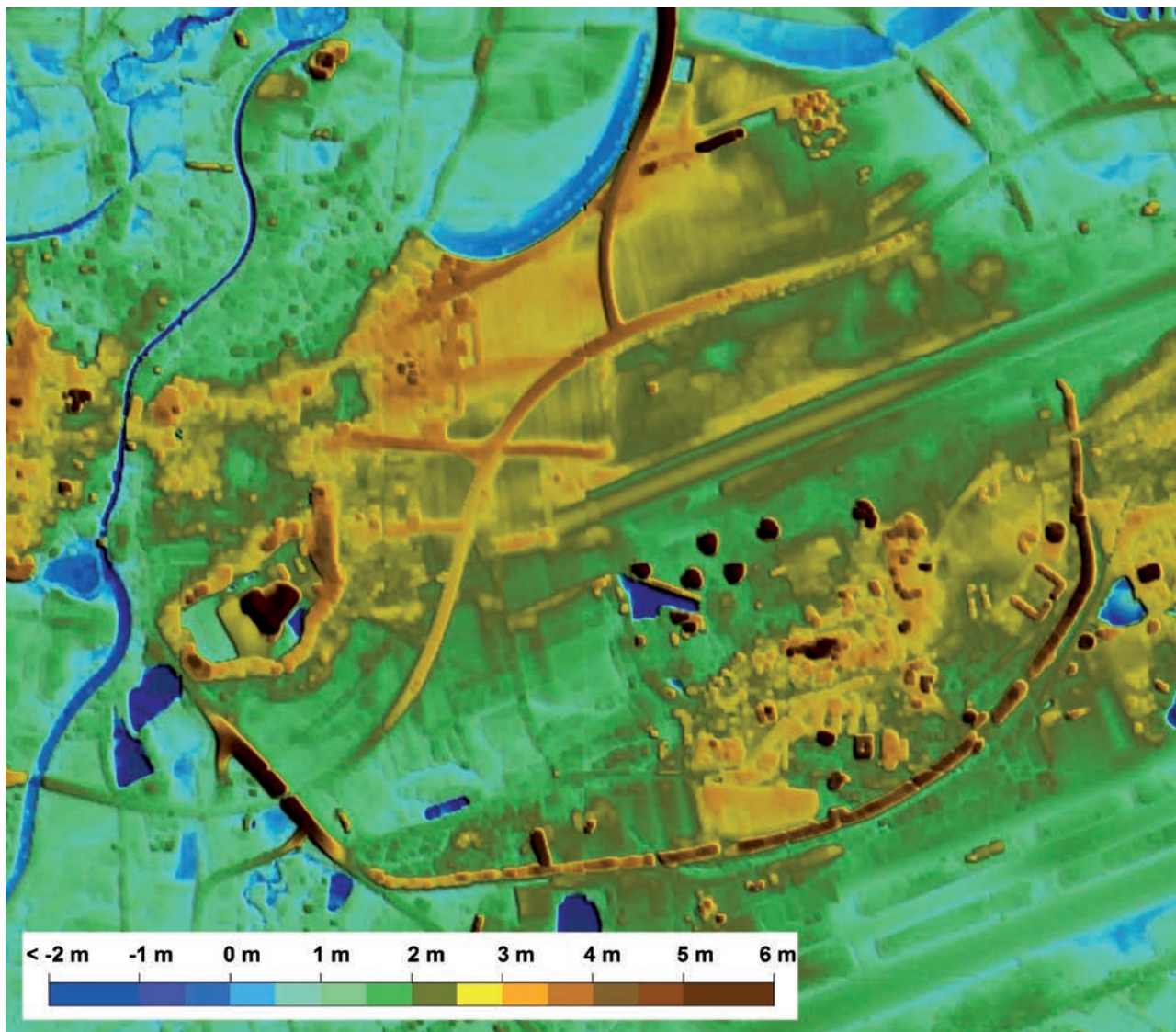


Fig. 2. Model of the distance between groundwater level and surface in the *oppidum* of Manching (image: Arauner 2015, p. 139 fig. 11).

been one of the main reasons why the *oppidum* developed at this site (Sievers 2007, p. 40). Geophysical prospection of this area revealed several symmetrically-arranged channels, which might have been used for docking ships (Völkel, Leopold 2007, p. 25; Leopold, Völkel 2013, p. 15-16).

The southern part of the *oppidum* directly adjoins the 'Feilenmoos', a bog, which was crossed by the Igelsbach river until the construction of the rampart circuit modified the area. Therefore, this area was both very marshy and affected by flooding events and was thus not very well suited for settlement or agriculture (Brestel 2017a, p. 21-23; Krämer, Schubert 1970, p. 40). A model of the distance between the groundwater level and the surface height (fig. 2), shows those areas most prone to wetness (see also Thiemeyer 1992).

The rampart and the modifications to the natural environment

The time span during which the *oppidum* was fortified with a rampart lasted approximately from 130/120 BCE, until the second quarter of the first century BCE, when the eastern gate through the wall burned down; it was not rebuilt thereafter (van Endert 1987, p. 30-32). During this period, excavations have shown three different construction phases of the rampart, the first in the *murus gallicus* technique and the following two of 'Pfostenschlitzmauer' type (Brestel 2017a, p. 342-354; Sievers 2010). Two of the gate positions, in the south and east, are still visible today. Another gate can be located in the west, where a bridge must have crossed the Paar river. At least one further gate is assumed to have existed in the north of the circuit (fig. 4) (Reinecke 1950, p. 23).

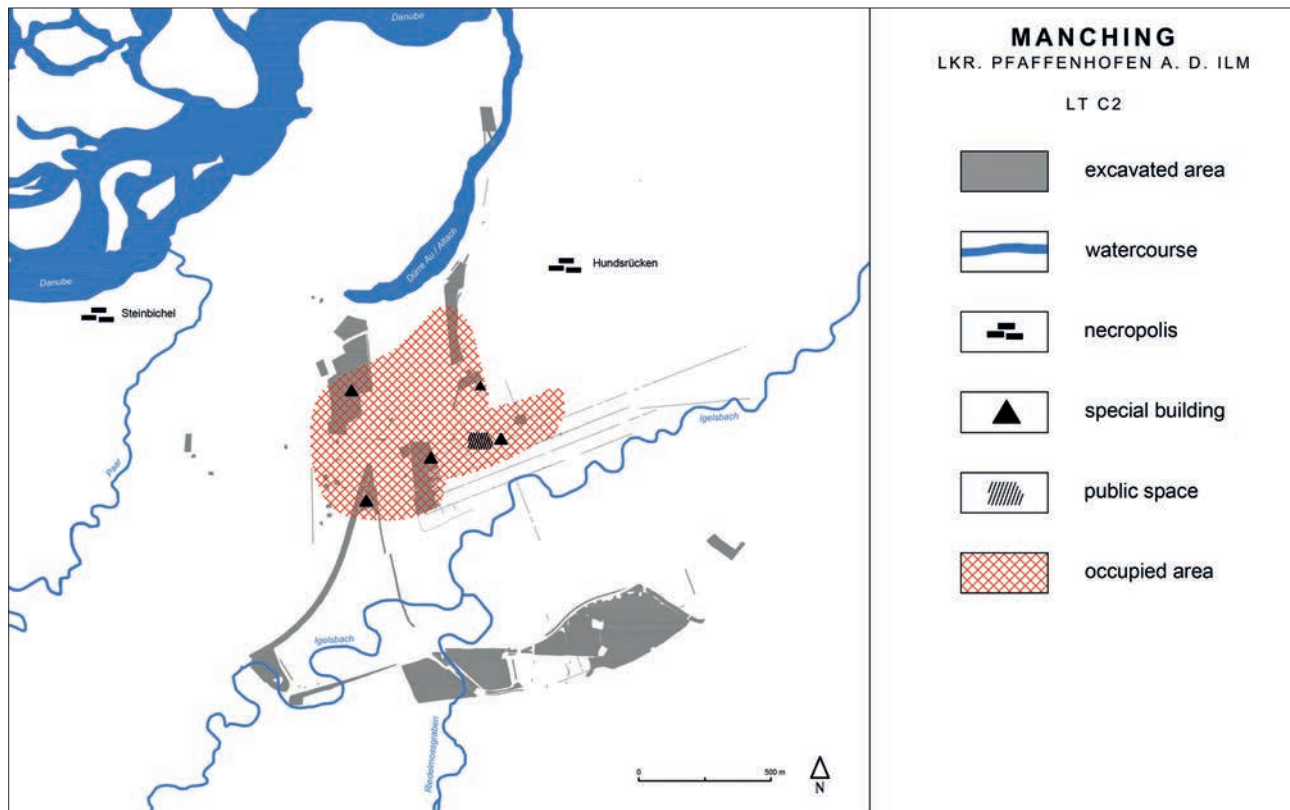


Fig. 3. Plan of Manching during LT C2 with watercourses before the construction of the ring-wall (image: T. J. Brestel with data from U. Arauner).

In addition to the construction of the wall, anthropogenic modifications to the natural environment took place. The redirection of the watercourses near the *oppidum* was suggested very early based on the location of old riverbeds *intra muros* (Krämer, Schubert 1970, p. 24; Reinecke 1950, p. 17). Research on the hydrology of Manching has revealed that they initially crossed the *oppidum* (fig. 3-4) (Peters 2002; Peters, Sievers, 2001). The course of the Igelbach, which originally flowed into the Danube to the north-east, was altered by digging a new riverbed so that it flowed into the River Paar to the west. The Riedelmoosgraben, which formerly flowed into the Igelbach (fig. 3), was redirected to flow around the south-eastern part of the rampart circuit (fig. 4). The watercourses themselves conformed to the circular shape of the *oppidum* and were used as moats to reinforce the fortification (fig. 4). Three quarters of the circuit was now protected by a natural or an artificial water course – without doubt improving its defensive capabilities (Brestel 2020, p. 187).

It is still unclear how the 'Dürre Au' was integrated into the circuit of the fortification. Was the course of the rampart interrupted by a gap or was the waterway bridged? How could it have been defended against attackers? Unfortunately, the northern part of the rampart is almost completely destroyed so that these questions can no longer be answered.

The circular shape of the Manching settlement was however not arbitrary but was intentionally chosen to make a connection to the pre-existing sanctuary in its centre (Sievers 2012, p. 119-120 fig. 2). The design of a major fortified settlement of circular shape, framed by water courses and with a central sanctuary

was not achieved by chance but was a representation of a cosmological concept and a demonstration of the abilities of the population of Manching (Brestel 2017b, p. 24).

Conclusion

During the Iron Age the changes to the fluvial landscape and vegetation, caused by increasing anthropogenic deforestation, led to regular and more extensive flooding events (Jerz, Peters 2002, p. 106; Peters 2002, p. 210). The redirection of the water courses and the construction of the rampart circuit might also have been a reaction to these changes to the natural environment (Peters, Sievers 2001, p. 70-71; Arauner 2015, p. 140-141). Geomorphological research has revealed that the densely occupied areas in Manching were mainly situated in sectors which were safe from the seasonal flooding events of the Danube (Trappe 2013, p. 7-8). Even so, the small river Paar was still a danger to the settlement as the identification of sediments of flooding events from the La Tène period prove (Völkel, Weber 2000, p. 389-390).

We can conclude that the settlement of Manching was fundamentally influenced by the local hydrogeography. On the one hand, the 'Dürre Au' allowed the construction of a harbour with a direct connection to the Danube, which transformed Manching into an important trading centre. The access to the Danube was also a great advantage for the construction of the rampart because the stones, brought from Neuburg an der Donau, a

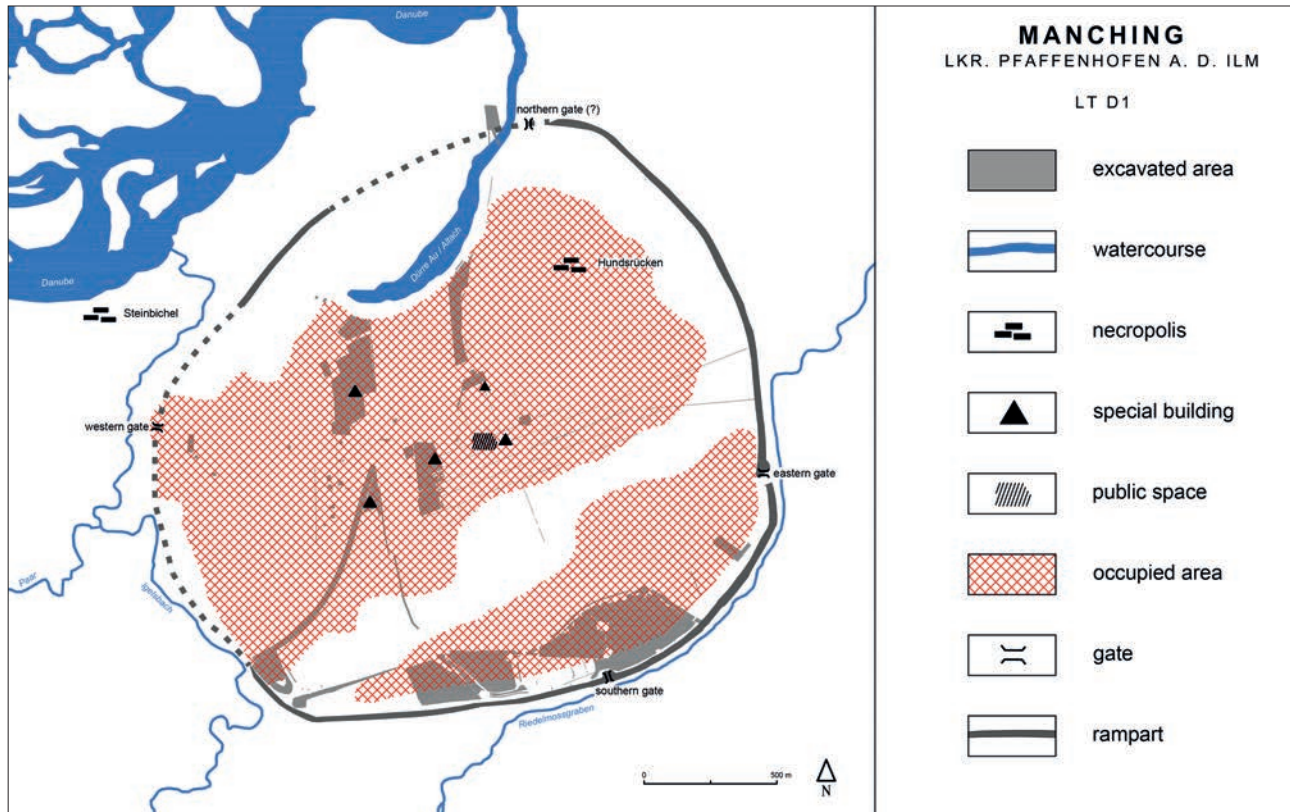


Fig. 4. Plan of Manching during LT D1 with watercourses after the construction of the ring-wall (image: T. J. Brestel with data from U. Arauner).

distance of ca. 25 km (Streit 1987, p. 117-118), and the oak timber for the *murus gallicus* were transported either by ship or on rafts. On the other, the high groundwater table was associated with problems for the local population: Some areas of the *oppidum* were marshy and neither suitable for agriculture nor the construction of houses; and the wetlands may also have enabled Malaria, which was present in the area in later times, to become endemic.

The inhabitants of Manching faced these problems (created by the site's location) by fundamentally changing the natural environment: they built a drainage system in the *oppidum*

(Thiemeyer 1992; Brestel 2017a, p. 34-39), redirected several water courses and constructed the rampart circuit to protect the *oppidum* against their enemies as well as flooding events.

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Résumé

Avec ses 17 coupes de rempart, la fortification (longue de 7 km) de l'*oppidum* de Manching, en Bavière, est l'une des mieux documentées pour le second âge du Fer. De plus, les recherches des deux dernières décennies ont montré des modifications considérables de l'environnement naturel, entreprises pour sa construction.

Le rempart n'a pas été érigé indépendamment du réseau hydrographique proche. Les cours d'eaux ont été détournées, au sud et à l'est de l'*oppidum*, et un système de drainage a été créé afin d'augmenter les terrains constructibles *intra muros*. Ces modifications ciblées ont été utilisées pour rendre la fortification plus efficace. Dans le nord de l'habitat se trouvait en outre un port, dans un bras mort du Danube, qui devait être ceint par la fortification.

Zusammenfassung

Mit insgesamt 17 Wallschnitten kann der Ringwall des Oppidums von Manching in Bayern als eine der am besten erforschten latènezeitlichen Befestigungsanlagen gelten. Die Forschung der letzten zwei Jahrzehnte hat zudem gezeigt, dass für den Bau der Befestigungsanlage eine erheblich künstliche Veränderung der natürlichen Umwelt vorgenommen wurde. Der Ringwall ist nicht isoliert zu betrachten, sondern ist unmittelbar mit den nahegelegenen Gewässern verbunden.

Im südlichen und östlichen Teil des Oppidums wurden Gewässer umgeleitet und ein umfangreiches Entwässerungssystem angelegt, um Bauland *intra muros* zu gewinnen. Diese gezielte Modifikation der Flussläufe wurde auch dazu genutzt, die Befestigung effizienter zu gestalten. Im Norden Manchings befand sich außerdem an einem Altarm der Donau ein Hafen, der aufwendig in die Befestigung integriert werden musste.