Transport of Heavy Loads on Inland Waterways

Stefan Wenzel

Transport connections are an important factor for the success of an industrial area. This applies all the more if its products are heavy products such as stones, where the transport costs significantly define the price for the final user. But even with bulk goods such as ceramics, the transport costs co-determined the attractiveness for the customers. Transport on water is more favorable in energy terms than transport on roads, it is faster and offers the possibillity to bundle large cargos. Large blocks of marble can be transported with teams of 16 oxen,[1] difficult to manage and costing considerable expanses for fodder. On the other hand, two horses can easily pull a big boat[2]. The Edict on Maximum Prices of Diocletian states that fluvial transport of goods costs the sixfold of transport on sea, while the expanses of transportation on land are sixty times that of carriage by sea.[3] Therefore the proximity to the Rhine as a major transport route was undeniably a location advantage for the millstone and tuff quarries[4] as well as for the potteries between Mayen and the Rhine (fig. 1). The first stage of the transport from the raw material deposits to the Rhine could be covered both by land and on the river Nette[5].

Land Transport as an Alternative to Fluvial Transport on the Nette

Between Mayen and Andernach two Roman major roads met, which were well-researched by Josef Hagen[6] and whose course has since been confirmed by new observations (fig. 1). The Roman road Mayen – Andernach was detected during the excavation of a cemetery of the Early Iron Age near Mendig[7] exactly where Hagen supposed it, under and right next to the current federal highway B 256. Apparently already the prehistoric burial mounds were lined up at the side of a path. Traces of the second arterial road were in places recognizable very recently in the fields between Mayen-Hausen and Fraukirch, where the route is not under modern agricultural roads.[8] Road transport was of crucial importance in modern times. The Nette was obstructed by several mill weirs then and considered not to be navigable[9] apart from its lower course, where building material was shipped upstream in 1727.[10] Around 1846, each year 1060 two-horse wagons and more than 20.000 one-horse wagons went with products from the quarries around Mayen in the direction of the Rhine.[11]

The Nette as a Waterway

The fact that especially heavy loads can be transported much easier and on a cheaper rate on the water than on land caused Josef Röder and Martin Eckoldt to suspect that in

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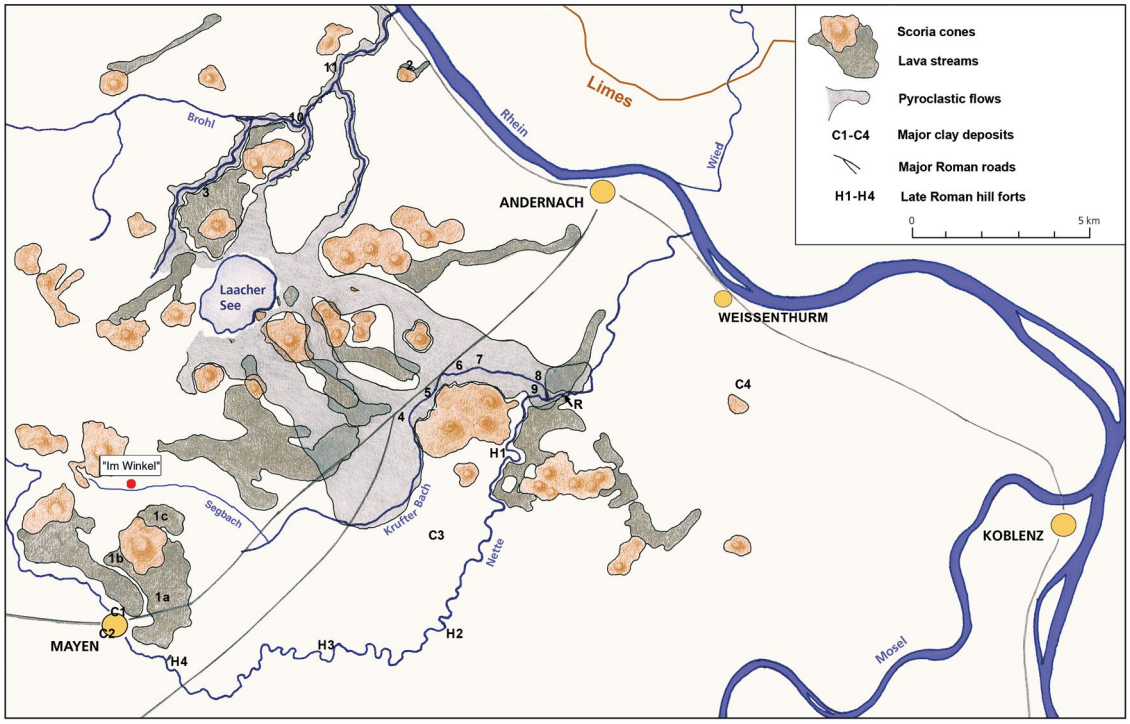

Fig. 1: The ancient quarrying and mining area near Mayen in the Eastern Eifel. Roman quarry districts: 1a–c Lava streams of the Bellerberg volcano (basalt-like lava, millstone quarries); 2 Andernach, Hohe Buche (basalt-like lava); 3 Wassenach, Mauerley (basalt-like lava); 4 Kruft, Hohe Straße (tuff); 5 Kruft, Ratskaul/Grube Idylle (tuff); 6 Kretz, Meurin 1 und 2 (tuff); 7 Kretz, Steinacker (tuff); 8 Plaidt, Sportplatz (tuff); 9 Plaidt, Kretzer Straße (tuff); 10–11 Brohltal zwischen Schweppenburg und Nonnsmühle (tuff). – Clay occurence: C1 Mayen, Alte Eich; C2 Mayen, Siegfriedstraße; C3 Kruft, Sibelco clay pit; C4 Kärlich, Mannheim clay pit. – Late Antique hill forts: H1 Ochtendung, Wernerseck; H2 Polch-Ruitsch; H3 Trimbs/Welling, Burgberg; H4 Mayen, Katzenberg. – R Rapids of the Nette stream at Rauschermühle.

Roman times the river Nette was also used as a waterway. Tuff blocks of 1.9 tons found in Cologne could only have been transported on the water[12].

The Nette has its source at Hohenleimbach in the High Eifel and flows after 55 km between Andernach and Weißenthurm into the Rhine.[13] The Nette is characterized by floods in winter and spring and low water in late summer and autumn (fig. 2). The mean water supply is around 2.5 m^3/s. According to Martin Eckoldt, in Roman times the Nette would have been 48 cm deep and navigable in "good maintenance".[14] The depth would have been sufficient for flat bottomed logboats or prams.[15] Yet smaller streams were used for transportation in modern times. Wood was floated on the small tributaries of the Nette[16] and there was a wood yard between Brückentor and Vogelsturm of the city walls of Mayen.[17] In the 18th century tuff was transported on rafts on the Brohlbach to avoid the ruined streets.[18]

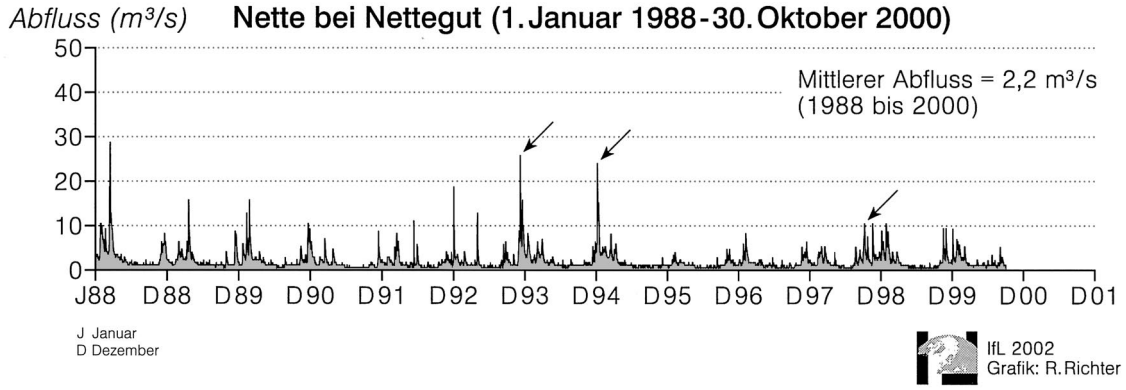

Fig. 2: Runoff regime of the Nette stream at Nettegut (January 1, 1988 – October 30, 2000, according to Beck 2003, Fig. 7).

In antiquity even water courses were used for navigation, which were so small that this was not permanently possible. Pliny the Younger reports that goods from his manor near Tifernum Tiburinum[19] could only be transported by water in the cool half of the year: »This river, which winds through the middle of the meadows, is navigable only in the winter and spring, at which seasons it transports the produce of the lands to Rome: but in summer it sinks below its banks, leaving the name of a great river to an almost empty channel … «[20].

There are rapids of the Nette at Rauschermühle at Plaidt (fig. 1, R), where the Nette crosses a lava flow of the Wannen volcano group. A simple answer to obstacles like this was to unload the cargo, transport it a short way on land, and to bring it on a ship downstream. Alternatively it is possible to lift the ships on a slipway with a winch.[21]

The use of the Nette for inland navigation is indicated by the position of millstone workshops within the *vicus* of Mayen, by the location of late antique hill forts as well as by the alignment of villas and grave monuments along the Nette at Andernach-Miesenheim.

In Mayen since the early imperial period a bundle of measures was implemented, which indicates on the one hand a possible influence of the state on the millstone production, and on the other hand the use of the Nette as a transport route for the millstones made of lava of the Bellerberg volcano. This program may have included to parcel out anew the quarries,[22] to relocate the settlement of Mayen into the valley and to establish separated quarters with potters and stone workshops,[23] to shift steps of quern production to the newly formed *vicus* on the river[24] and to establish new quarries on the side of the lava flow towards the Nette. In Roman times, new quarries were opened on all lava flows of the Bellerberg, but a particular large number on the southwestern flank (fig. 3). If one wanted to bring the millstones to the transfer site in Andernach, one extracted them just on the side facing away from Andernach and made a detour, if one brought them first down to finish them

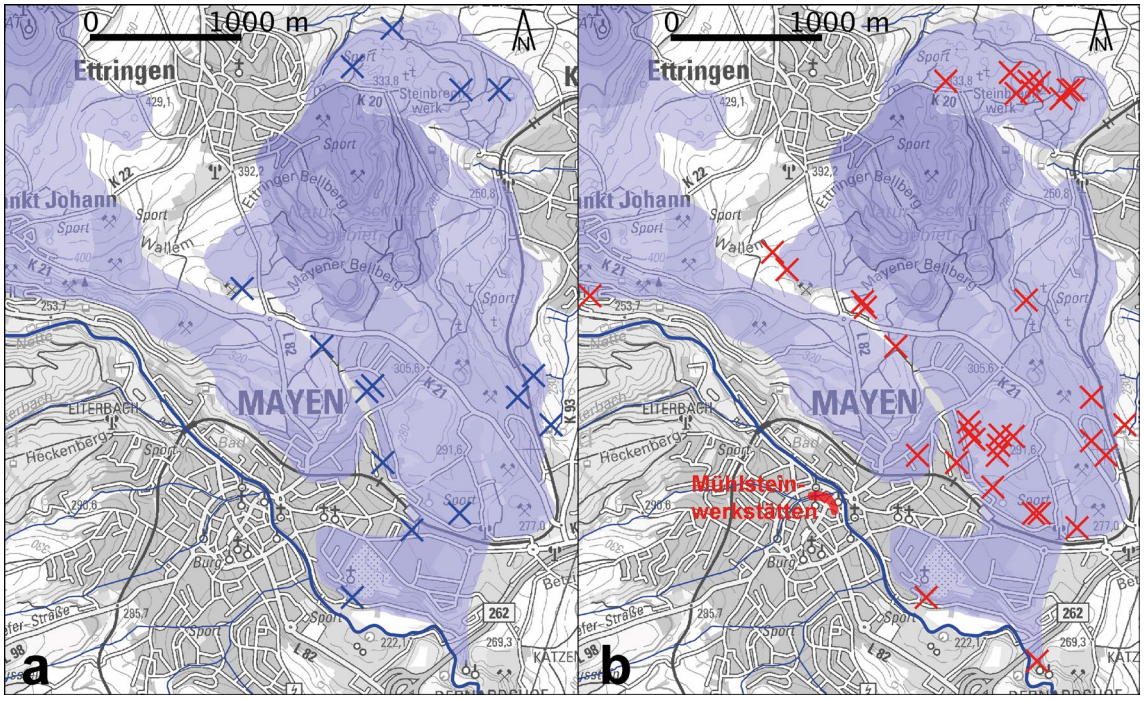

Fig. 3: Distribution of the millstone quarries in the lava streams of Bellerberg volcano in the Late Iron Age (a) and in Roman times (b).

in Mayen. But both was just then advantageous if one transported the millstones on the Nette. A bank stabilization of unknown age with horizontal oak logs was found near one of the stone workshops »Im Keutel«, next to it was a Roman road with a remarkable coating, 75 cm thick and ›hard like concrete‹, and vertical wooden pecks on the side towards the Nette.[25]

Late Roman hill forts were preferably sited on traffic routes such as rivers and roads. The presence of a whole chain of hill forts along the Nette (fig. 1, H1-H4) indicates the use of this river as a waterway.[26]

In addition, at the lower course of the Nette near Miesenheim a large villa and several grave monuments are orientated towards the river (fig. 4, a-c). Such a line-up is also known from other areas, where merchants and landowners preferred to build their elaborate mansions and tomb monuments along waterways, sometimes right next to stone quarries.[27] At Miesenheim there are some larger pillar monuments of Lorraine limestone next to the Nette[28] (fig. 4, c), as well as a burial chamber made of large tuff blocks[29] (fig. 4, b), which certainly had a considerable superstructure. Since no major Roman roads are known in this area, the monuments were designed to be seen from the Nette.

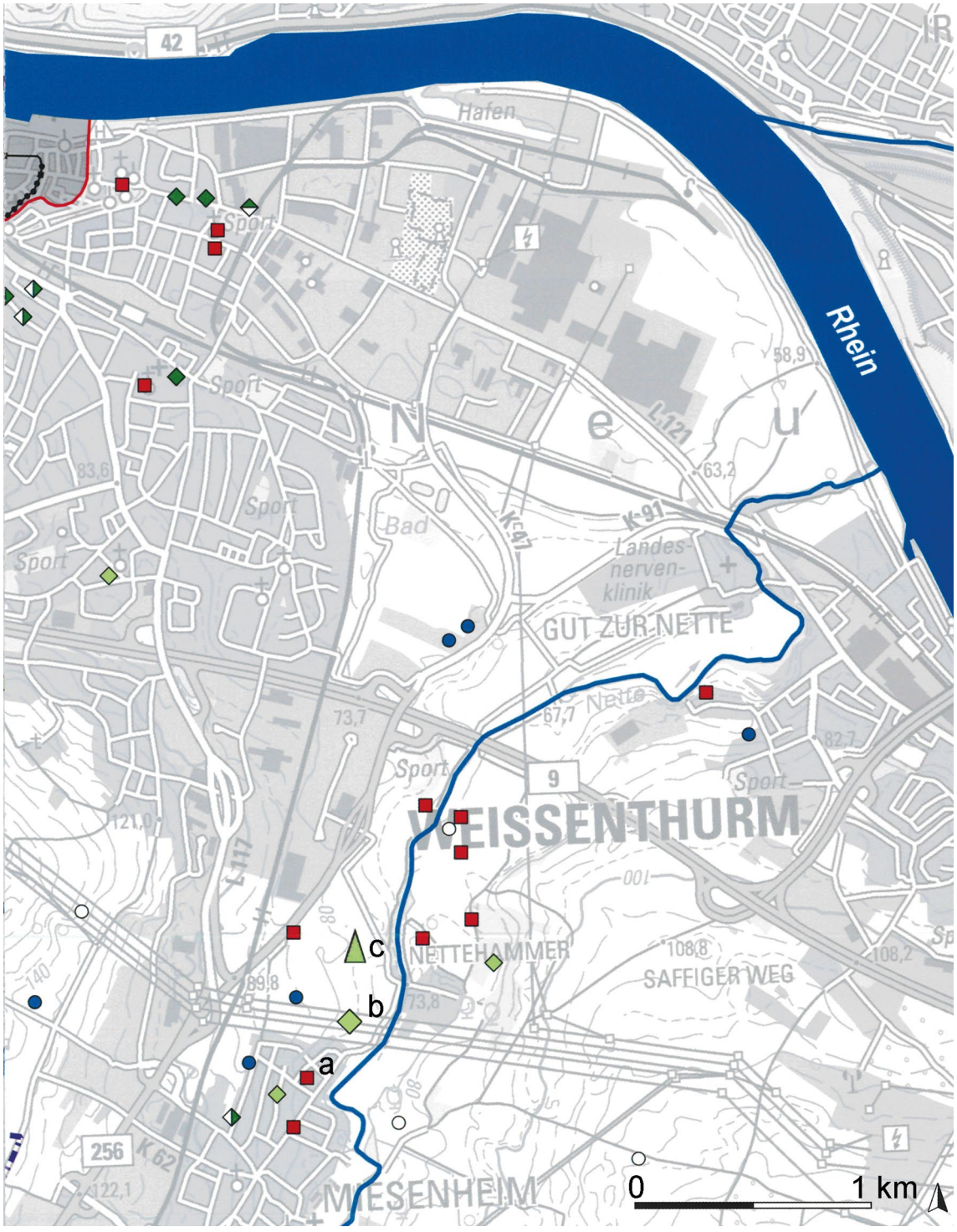

Fig. 4: Lower course of the Nette stream near Miesenheim with villas and grave monuments (settlements: in red, graves: in green, water pipes: in blue).

Possible Use of the Segbach as a Waterway

There is evidence that even a small tributary of the Nette could have been used as a waterway, even if a watertight proof for this is still outstanding. It is the Segbach, which could have been connected the northern edge of the quarry area wih the *villa* and the *burgus* »Im Winkel« to the Nette via the »Krufter Bach« stream.

The residents of the *villa* produced querns, proved by more than 21 rough outs found in the filling of a cave in the main building (fig. 5, 2), and quarry rubble found close to the settlement site (fig. 5, 10)[30]. After destruction of the main building, a *burgus* was built around 300 AD as a presumably fortified granary (*horreum*) (fig. 5, 5). Below the *burgus* was a surface drainage.

The granary could contain the annual supply in cereals for more than 200 persons. Six ballista bolt heads and further militaria suggest that it was protected by armed forces. The ceramic findings imply that the state ascertained supply and protection for the quarry workers until the 5th century.

Adjacent to the Segbach, the drainage system dewatered an area of almost 1000 m^2 from a parabolic tip through two sewers connected by transverse gutters towards the northeast. The drainage sewers cut clay layers with samian ware of the early to middle imperial period. Ceramics from the filling of the drainage and from their overlying strata date this installation to the Late Antiquity. It seems reasonable to suppose that the drain dried up a reloading site, where large quantities of grain were delivered and heavy millstones were shipped. Walls crossing the flood plain of the Segbach (fig. 5, 6.7b) or forming a funnel shaped structure (fig. 5, 7c) could have served to guide the water. A wall now intersected by the Segbach (fig. 5, 7a) has bounded a kind of basin cut into alluvial clay from the Early to Middle Imperial period. The alluvial clay is dated by a sherd of a bowl Dragendorff 29 and by sherds of ›Iron Age fabric‹, the trenched structure contained pottery of the third century and a group of five terracotta figurines (Cybele and four matrons).[31] Walls bordering the Segbach have the appearance of bank revetments (fig. 6). A Roman origin of these walls is plausible because only building structures of Roman age are known from this site. Next to the illustrated section a wooden half-round gutter dendrodated to around 208 AD was found.[32]

Outlook

Although fluvial transport has left few traces, it must have been of great importance in Antiquity. In the Segbachtal it may be possible to gain insights on the use of a small stream by examining the presumed hydraulic structures that are today partly located in the groundwater range.

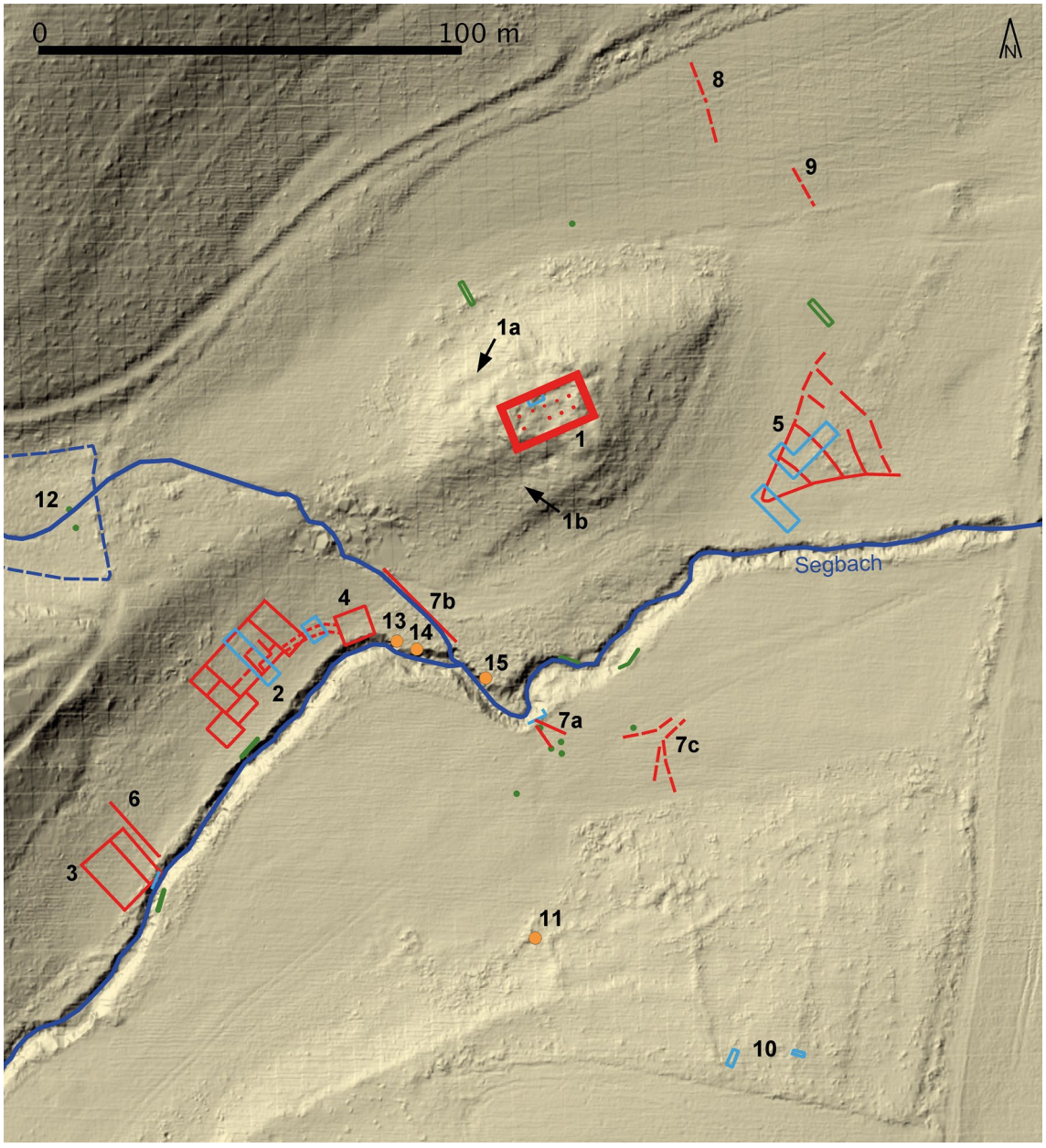

Fig. 5: Mendig, »Im Winkel«, plan. Archaeological trenches (blue), geoarchaeological trenches (green), walls and drains (red) clearly visible on the georadar. 1 burgus; 1a step in the terrain; 1b possible entrance; 2 main building; 3 secondary building; 4 small stone building; 5 drains; 6-9 walls (the findspot of the matrons is at 7a); 10 linear stone heaps / buried quarry rubble; 11 presumed location of a building; 12 possible reservoir of unknown date.

Fig. 6: Mendig, »Im Winkel«. Wall bordering the Segbach.

Notes

[1] Smerdel 2006, fig. 1

[2] Descombes 2007, 88 fig.

[3] Kunow 1983, 53–54 fig. 5; Wefers 2012, 168 fig. 62.

[4] Mangartz 2008, 97–106; Schaaff 2015, 210–211; Geisweid 2018, 37.

[5] Redknap 1987, 90.

[6] Hagen 1931, 287–290.

[7] Brücken 2009, 77 fig. 22. fig. 43.

[8] von Berg 1995, 5.

[9] Meesen – Meesen 1998, 74.

[10] Weidenbach 1923, 59.

[11] Prößler 1991, 17.

[12] Eckoldt 1980, 89. 116 note 242.

[13] Wenzel 2014, 231–232, with earlier references.

[14] Eckoldt 1980, 89.

[15] Slightly smaller vessels than those described by De Boe – Hubert 1977, 24; Bockius 2004, fig. 10.

[16] Schmitt et al. 1997, 16.

[17] Schüller 2005, 42.

[18] Pohl 2012, 55.

[19] Braconi – Uroz-Sàez 2008, 93.
[20] Plin.epist. 5, 6, 12.
[21] Voß 2011, 40. 43; Weski 2014, 103–104.
[22] Hörter et al. 1955, 12–13 fig. 4; Mangartz 2008, 91 fig. 27; Mangartz 2012, 14–15.
[23] Oesterwind 2000, 37–38; Hunold 2002, 81; Glauben 2012, 89–90 fig. 3; Giljohann et al. 2017, 130; Hunold – Schaaff, this volume.
[24] Mangartz 2008, 73–74. 90.
[25] Hunold 2002, 75–76 fig. 2.
[26] Hunold 2011, 370.
[27] Beal 2006/2007, 2; Paulke 2010, 55 fig. 7.
[28] Schröder 2016, 15 note 22; Giljohann – Wenzel 2015, 24.
[29] Eiden 1977, 59–60; Noelke 2010, 480–481 fig. 55.
[30] Wenzel 2012, 135 fig. 6. 139.
[31] Dotterweich et al. 2012, 88–193; Wenzel 2012, 139–142; Wenzel forthcoming.
[32] Dendro-dating by Thomas Frank, Cologne.

Image Credits

Fig. 1: Graphic A. Hunold, RGZM. – Fig. 2: after Beck 2003, Fig. 7. – Graphic R. Richter, IfL. – Fig. 3: Location of quarries after Mangartz 2008; Hörter 2005; Hunold 2011; Oesterwind – Wenzel 2012. Base map: TK50 L5708 © Geo-Basis-DE / LVermGeoRP (2018), dL-de / by-2-0, http://www.lvermgeo.rlp.de. – Fig. 4: Modified after Giljohann 2017, supplement 1. Base map: TK50 L5708 © Geo-Basis-DE / LVermGeoRP (2018), dL-de / by-2-0, http://www.lvermgeo.rlp.de. – Fig. 5: Georadar S. Seren, ZAMG; LiDAR. ©GeoBasis-DE/LvermGeoRP 2017, processing A. Cramer, RGZM. – Fig. 6: Photo: S. Wenzel, RGZM.

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