

URBANISTIC STUDIES IN AQUILEIA

Stefan GROH

Izvleček

[Urbanistične študije v Akvileji]

V okviru raziskovalnega projekta Avstrijskega arheološkega inštituta pri Avstrijski akademiji znanosti so med letoma 2011 in 2017 potekale raziskave antične topografije in zgodovine Akvileje. Delo je bilo osredotočeno na zahodni del mesta ter severno, zahodno in južno predmestje s prometnicami. Neinvazivne arheološke metode (fotogrametrija, daljinsko zaznavanje, lidarske analize, geofizikalne meritve, površinski pregledi, jedrne vrtine) so prinesle pomembna nova spoznanja o morfologiji in diahronem razvoju rimske kolonije. Poseben poudarek je bil na preučevanju mestnih utrdb ter analizi razvoja mestne infrastrukture s prometnicami in kanali. Z zbiranjem površinskih najdb smo intenzivno raziskali območje amfiteatra in obe strani kanala Amfora.

Glavne besede: Italija, X. regija, Akvileja, arheološke raziskave, kanal Amfora, mestno obzidje, infrastruktura

Abstract

In the framework of a research project of the ÖAI/ÖAW, studies on the ancient topography and history of Aquileia were conducted from 2011–2017. The work focused on the western part of the city as well as the northern, western, and southern suburbs with the traffic routes. Using non-invasive methods of archaeology (photogrammetry, remote sensing, LiDAR analyses, geophysical measurements, surveys, and core drillings), important new insights into the morphology and diachronous development of the Roman *colonia* were obtained. Particular emphasis was placed on the study of urban fortifications and on the analysis of the infrastructural development of the city by traffic routes and canals. An intensive survey was carried out with the collection of surface finds in the area of the circus and on both sides of the Canale Anfora.

Keywords: Italia, Regio X, Aquileia, archaeological surveys, Canale Anfora, city wall, infrastructure

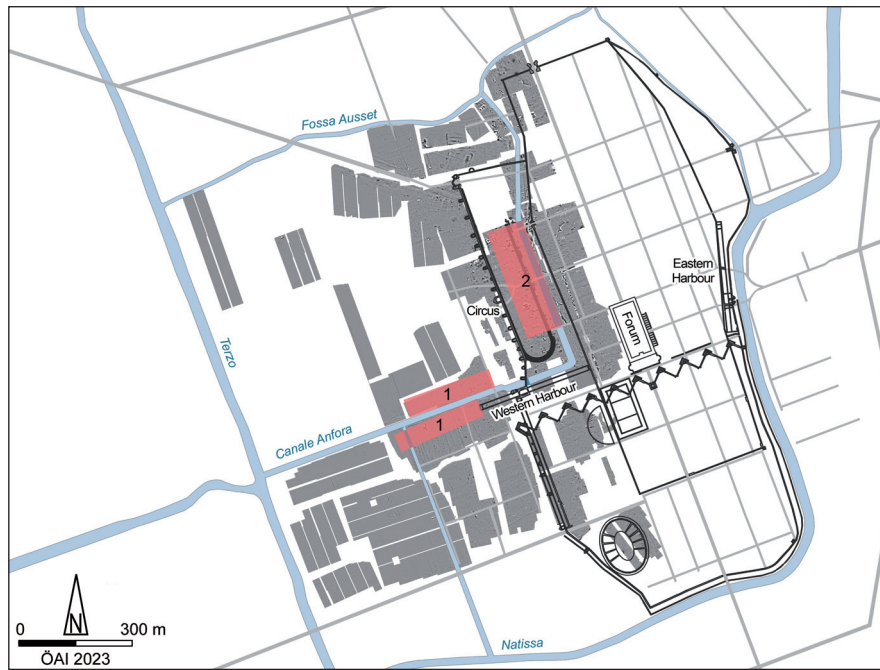


Fig. 1: The areas of research 2011–2017 in Aquileia. Grey: geophysical prospection, streets. Red: intensive surveys. Blue: rivers and canals (ÖAW/ÖAI, F. Schimmer, H. Sedlmayer).

INTRODUCTION AND METHODOLOGIES

The project “Urbanistic studies in Aquileia”, carried out from 2011–2017 by the former department of Central European Archaeology (ZEA) of the Austrian Archaeological Institute/Austrian Academy of Sciences (ÖAI/ÖAW), studied the diachronic urbanistic development and the cultural and economic history of this trading port at the upper Adriatic coast, using mainly non-invasive archaeological methods (geophysics – radar, resistivity / magnetics / remote sensing / LiDAR / core drilling / survey). The huge amount of heterogeneous data was manipulated in a GIS (Fig. 1).¹

The project comprised a large-scale geophysical survey of the town’s western *suburbium* (2013–2015).² Intensive field surveys were carried out in two areas covering the artisan quarter, the harbour and the Late Antique/Byzantine town within the city walls (circus-area) (2013–2015). Geo-archaeological coring was done in the area of the newly discovered branch of the Canale Anfora and in its run towards the Adriatic Sea and in the newly detected port and artisan quarter as well (2013–2015). The project’s main focuses laid on the interpretation of the archaeological features of the

geophysical survey and the analysis of the finds from the surveys (130,000) (2014–2017). Additional geophysical prospecting was undertaken in the theatre and amphitheatre of Aquileia. Archaeological core drilling was intensified and allowed to give more insight in the sequences of archaeological layers within the building structures along the Canale Anfora and in the circus-area. One of the most important developments of new methods was the systematic archaeological core drilling which differs quite from the geological coring. Inspired by the geological methodologies the workflow of core-drilling was adapted for archaeological purposes. More than 20 cores were drilled in the newly detected harbor area and the Canale Anfora. The method is very efficient, almost “non-invasive” (cores of 7–8 cm) and supplies one with insight into the stratigraphy without excavations. Fragments of diagnostic findings give an idea of the diachronic development of a building or of natural environment and archaeobotanical and archeozoological remains allow (at least) radiocarbon dating.

The results of the research project allow to design a new map of the ancient town. The geophysical prospectings were conducted in an area of more than 70 ha in the western part of the town and in the suburbium along the Canale Anfora. The new image of Aquileia allows to interpret the development from the beginning of the commercial center in the 1st century BC, situated along the Canale Anfora, to the building of the Late

¹ The project was funded by the Austrian Science Found (FWF P25176-G19).

² Additional research on the settlement structures in the surroundings of Aquileia was undertaken in the villa of S. Canzian, Groh 2015.

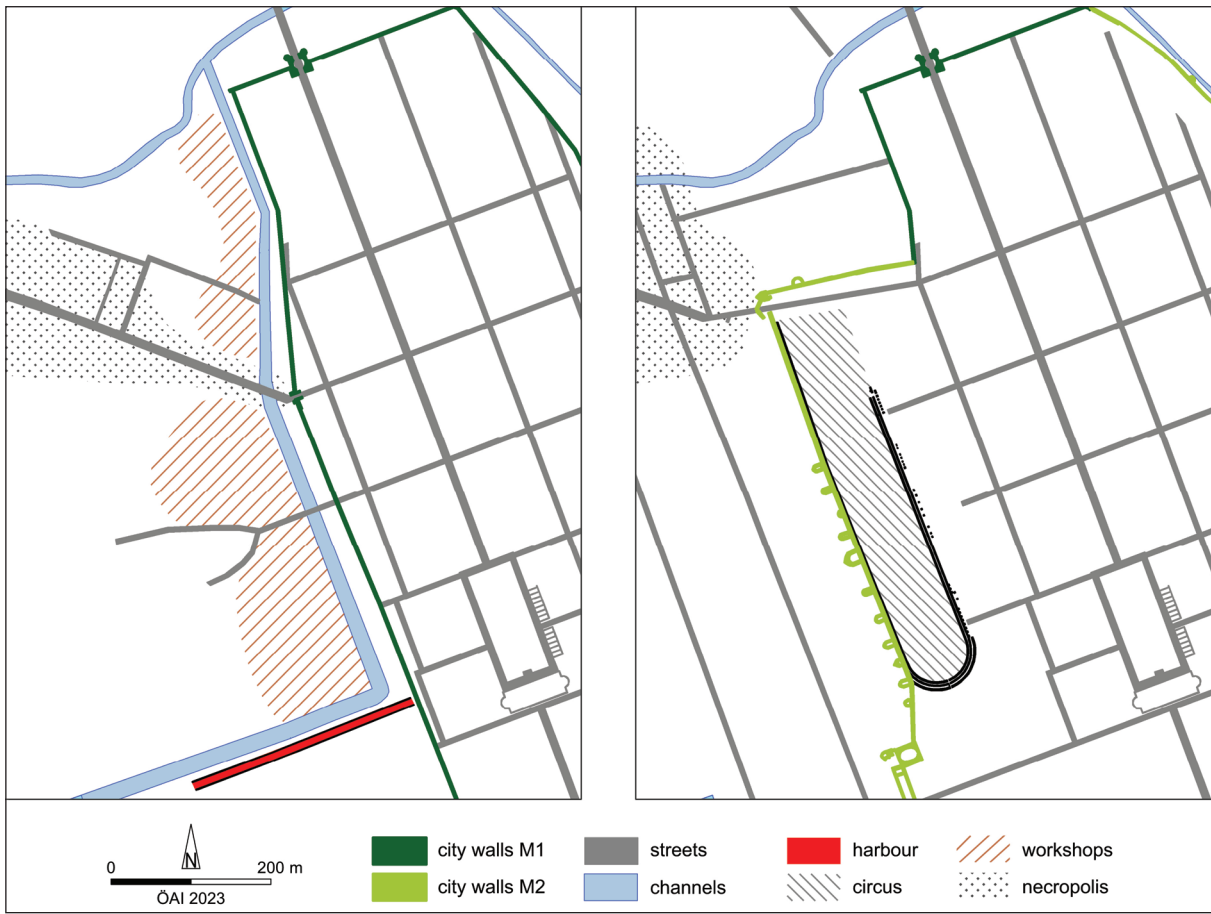


Fig. 2: The urban development in the northwest of Aquileia. Left: artisan quarter and western harbour in the area of the Canale Anfora until the end of the 3rd century AD. Right: circus and late antique city wall in the 4th/5th century AD (ÖAW/ÖAI, H. Sedlmayer).

Antique city walls at the end of the 3rd and beginning of the 4th century AD and the settlement patterns in the 5th century AD. The modification of the urban design was directly connected to ecological and hydrological changes, what could be proofed and dated by the cores in the Canale Anfora and its surroundings.³ In the Imperial era, there were harbour installations in the west and east of the town, in the 3rd century/Late Antiquity, the Canale Anfora silted up, the western harbour was abandoned and the western suburban zone was used as a deposit area for waste and rubbish (Fig. 2–3).

A special emphasis was laid on several buildings of infrastructure as water basins⁴ or monuments, as there are *horrea* and workshops along the Canale Anfora, the buildings of the *ludus* (amphitheatre, theatre, circus) and a new structure in the northwestern suburbium a *basilica fuori delle mura*. The results of the geophysical prospec-

tions in the theater and amphitheatre were verified by excavations of the Universities of Padua and Verona.⁵

A striking new feature is a huge Early Christian *basilica* which was built over tombs of the Imperial necropole, flanking the Via Annia, the main road which connects Aquileia with Italy (Fig. 5: C). The *basilica* was installed after the Late Antique enlargement of the town, close to the city wall and the circus. Intensive surveying in the area of the *basilica* proofed its decor with stone and glass mosaics. The interpretation of the internal building structures seems to confirm a three stages-development from a tomb of a Martyr to a chapel and a *basilica* of Martyrs. Beside the *basilica* several buildings indicate a monastery – a new aspect for the Early Christian period of Aquileia.⁶

The geophysical prospections inside of the city walls give new information on the street grid and densely built areas. In the forefront of the town, southerly of

³ On the diachronic development of the Canale Anfora: Bonetto et al. 2020, 175–202.

⁴ Groh, Buora 2018.

⁵ Basso et al. 2024, in this volume.

⁶ A detailed study of the new Early Christian *basilica* of Aquileia is in preparation.



Fig. 3: Idealized reconstruction of the urban development of Aquileia: 1 – the Roman imperial period; 2 – Late Antiquity (ÖAW/ÖAI).

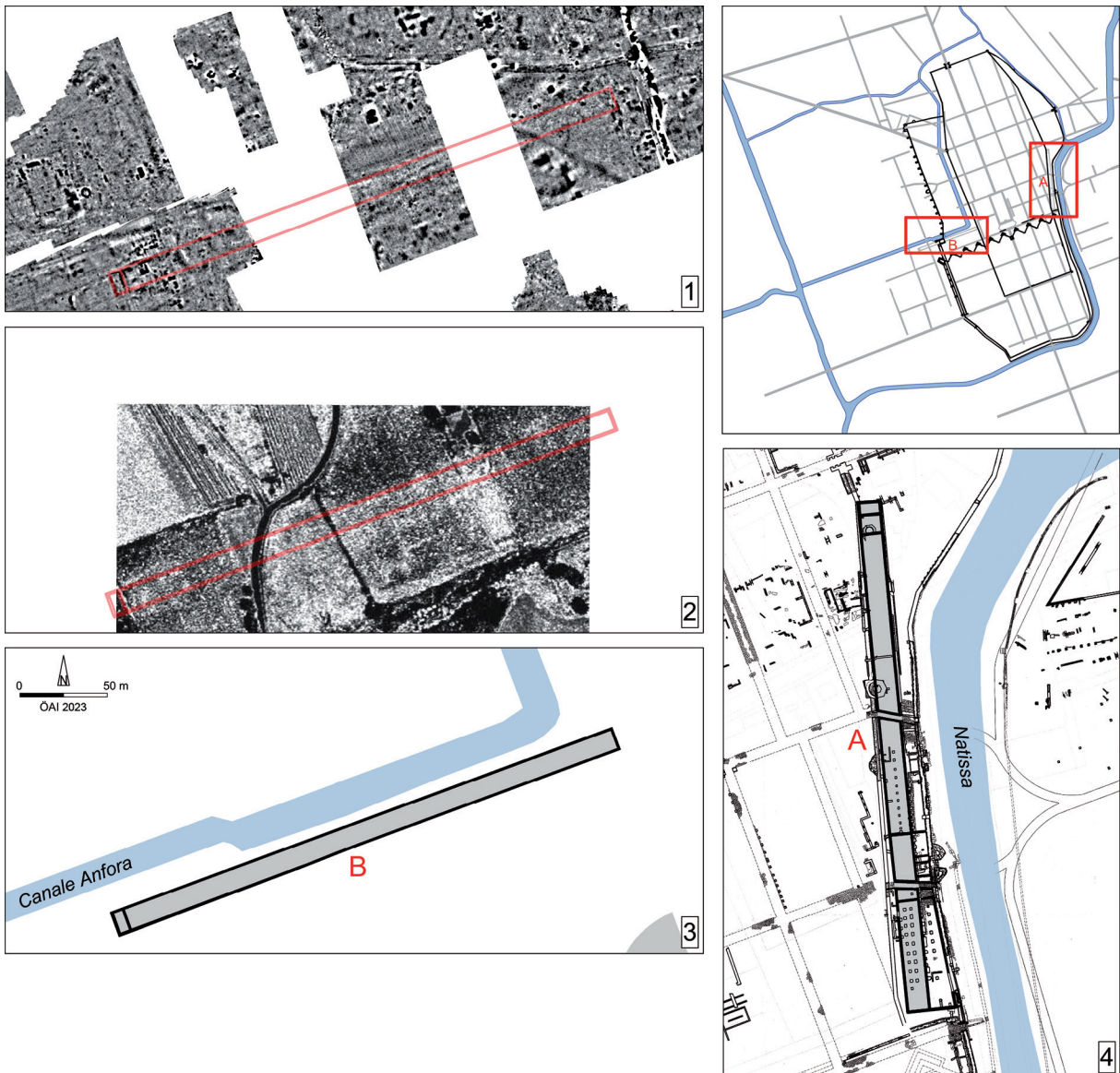


Fig. 4: The geophysical evidence for a hall building on the south side of the Canale Anfora, which is interpreted as a harbour building. 1 – magnetic survey; 2 – aerial picture; 3 – interpretation; 4 – the hall building on the Natisone river serves as a comparison (ÖAW/ÖAI, H. Sedlmayer; city map: Bertacchi 2003).

the Canale Anfora, a regular ditch system indicates a drainage system, a rectangular structure could possibly be interpreted as the boundary of a temporary military camp. The presence of soldiery is proofed by artefacts of the intensive survey in the Canale Anfora-area from the Republican era until the 4th/5th century AD

CANALE ANFORA AND CIRCUS-AREA

Founded as a *colonia latina* in 181 BC, Aquileia played a key role in the military, economic and political development of the northern provinces, especially Noricum and Pannonia. Due to its topographically

advantageous location on a widely branched network of rivers and canals, the town soon became the main trading hub in the upper Adriatic region. In the framework of the research project, valuable new insights into the street grid, topography, the course of various rivers and canals as well as the urban and suburban development of Aquileia were gained. An artisan quarter situated along the Canale Anfora and a hitherto unknown, second harbour were discovered in the western *suburbium* and important new evidences were documented on the Late Antique fortification system (Figs. 2, 3, 5).⁷

⁷ Groh 2012, D1–11; Groh 2013a; Groh 2013b.



Fig. 5: Terrain model of Aquileia based on Lidar data with the course of rivers and canals, the street grid and selected features. A – Harbour on the Natissona; B – Harbour on the Canale Anfora; C – Early Christian *basilica* (ÖAW/ÖAI, H. Sedlmayer).

In the magnetic measurement data, a branch of the river (already sedimented in antiquity) is recognizable, which bends northwards in the extension of the Canale Anfora in the area of the circus and follows the course of the Republican city wall from there to its confluence with the Fossa Ausset. This canal/river is approx. 20 m wide up to the bend to the north and then narrows to approx. 15 m until it joins the Fossa Ausset. The average width of the Canale Anfora, excavated east of the confluence with the Terzo in 1987–1988, is 16 m, with a depth of 4 m. The distance between the Republican city wall and the canal is approx. 10 m in the north and approx. 14 m in the south. Obviously, the Canale Anfora

flowed into a river that bordered the western side of the Republican and Imperial city. The topography to the west of this river shows a clear depression in the terrain, and the Republican/Imperial city was built in an elevated position to the east of the river (Fig. 5).

To the west of the north-south section of the canal, strong anomalies in the geophysical data indicate the existence of workshops. This suburban workshop district extends from the Fossa Ausset to the Canale Anfora over a length of approx. 730 m along the canal. The measurement data show workshop buildings (under the area of the later Circus) oriented towards the canal on strip-shaped plots. Oven batteries can be seen in the

individual buildings of this quarter. The factories had access to important water resources and were conveniently located close to the city and between the port on the Canale Anfora and the Via Annia. The geophysical evidences were proofed by the core-drilling in this area. A road leading west from the city and crossing the canal provides access to the suburban workshop district almost centrally between Via Annia and Canale Anfora. The road forks approx. 100 m west of the republican city wall into two streets at least 70 m apart (*Fig. 2*).

In the geophysical data, linear structures running parallel from the late antique gateway with an oval courtyard to the east can be recognised at a distance of approx. 10 m from each other (*Fig. 4*). These anomalies, which can be traced over a length of 167 metres to the Republican/Imperial city wall, can most probably be interpreted as walls on the basis of the georadar data. The southern course of the wall (with pilaster strips on the outer [south] side) was excavated 26 metres below the gate. An aerial photograph shows that these double walls, which run parallel to the Canale Anfora at a distance of 8 metres, continue for approx. 96 metres to the west of the Late antique gateway. The total length of the hall building is at least 290 metres (*Figs. 4: 3; 5: B*). The ground plan and the design of the south wall with pilaster strips are reminiscent of the west hall of the river harbour on the Natisone in the east of the city (*Figs. 4: 4; 5: A*).⁸ This probably identifies a new harbour facility on the south side of the Canale Anfora in the western suburbium of the imperial city, which corresponds in terms of building typology to the contemporary west hall of the harbour on the Natisone. It is 296 metres long, 13 metres wide and has pilaster strips on the eastern outer wall. Between the west hall and the Natisone river there are 8–15 metre wide piers. The west hall with warehouses is most recently reconstructed as a portico with arcades open to the river, with reference to the porticus Aemilia in Rome; the entire harbour complex probably dates to the Flavian period and is adapted to Late Antiquity (*Fig. 4: 4; 5: A*). Consequently, from the Republican period until the abandonment of the harbour south of the Circus in the 3rd century AD, at least two huge harbour facilities with hall buildings can be expected in Aquileia. These are located in the east and west of the city centre at the level of the forum. The harbour on the Canale Anfora, which reached up to approx. 100 m from the forum, was certainly connected to the Decumanus via a city gate and was therefore well integrated into the intra-urban road system. The Macellum and Comitium to the north of the forum are also located closer to the harbour on the Canale Anfora than to the harbour on the Natisone (*Fig. 5*).

⁸ Groh 2016, 189–192.

LATE ANTIQUE FORTIFICATION SYSTEM

Based on the interpretation of the geophysical measurement data, the fortification of the city wall with its towers in the section of the circus could now be completed for the first time (*Fig. 6*)⁹. Two new U-shaped towers can be recognised in the northern part of the measurement areas (Tower 9: approx. 8.1 × 13.9 m; Tower 11: approx. 8 × 13.9 m), of which the southern one (Tower 9) has already been documented by M. Buora and V. Roberto on the basis of an analysis of aerial photographs¹⁰. South of the large semi-circular tower (Tower 8) two new towers can also be identified (Tower 6 approx. 9.2 × 10.9 m; Tower 7: approx. 8 × 13 m).

In its final form, the late antique city wall was fortified over a section of 327 metres with a total of 11 towers at an average distance of 30 metres. A U-shaped tower (Tower 1) is added to the north of the Late Antique gateway with an oval inner courtyard, followed by a sequence of U-shaped (Towers 3, 5, 7, 9, 11; *Fig. 6*: in red) and pentagonal/semicircular towers (Towers 2, 4, 6, 8, 10, 12; *Fig. 6*: in black). The same tower density was probably also aimed for to the south of the gateway complex with its oval inner courtyard; in this area, where excavations were carried out, two pairs of pentagonal and semi-circular towers are present. The distance between these towers is again approx. 30 metres. The pentagonal towers in this south-western section of the Byzantine fortification were erected at least every 120 metres, but probably also at intervals of 60 metres, as in the north-western section¹¹.

RESULTS OF THE ARCHAEOLOGICAL SURVEY

The analysis of the collected artefacts has great methodological impact on urban and suburban sample strategies of archaeological surveys.¹² A combined intensive field survey and metal detector-survey was done. Normally, the metal-findings are quite under-represented in archaeological surveys, but in the case of Aquileia, where detector surveys were never not allowed, they indicate the presence of fishermen (lead and ceramic net sinker), metal-working, military and give an impression of the coin circulation.

The sample strategies were adapted to the huge amount of findings (130,000) and the time limit of three years. The Canale Anfora (area 1–2,4 ha) was surveyed in two zones without sampling, collecting all pieces bigger

⁹ Groh 2013a, 177–190.

¹⁰ Buora, Roberto 2010, 327–329, fig. 7a–b.

¹¹ Latest research on the city walls of Aquileia: Basso et al. 2024, in this volume.

¹² The findings were processed by F. Schimmer, P. Donat (all types of finds except coins), U. Schachinger and A. Stella (coins).



Fig. 6: The Late Antique city wall of Aquileia in the area of the circus. Sequence of semi-circular, horseshoe-shaped and pentagonal towers, 1–12 (ÖAW/ÖAI, H. Sedlmayer; city map: Bertacchi 2003).

than a thumb; in the circus area (area 2.3 ha) we sampled one of two grids (see Fig. 1: red areas). The amount of ceramics is much higher inside the city wall (circus area) than in the Canale Anfora area, the spectrum is dominated by pottery vessels (85/81%), amphorae are over weighted by 67/48%. The main import of amphorae and red slip ware leads to North Africa. Finally all the findings and find groups were compared to the evidences in Aquileia and the upper Adriatic ports.¹³

Interesting methodological analyses were done on the fragmentation and sampling strategies and on filtering “diagnostic” pieces combining size and weight of the findings. The diachronic distribution pattern of the surface findings shows a background noise from Republican time until Late Antiquity but a peak in the Canale Anfora area in the 1st century AD, when the harbour installations were built. Further peaks are in the Canale Anfora and circus areas in the 3rd century AD. In the 4th and 5th century AD the find numbers are quite

reduced in the Canale Anfora area. The number of cargos is much higher in the Canale Anfora area than in the circus. There are evidences of glass production in the northern zone of the Canale Anfora.

Combining the results of the geophysical prospections and the surface findings, the picture is much more complex. In the Canale Anfora area, there can be differentiated two zones: the installations of the harbour (1st century BC–3rd cent AD) from a zone of Late Antique deposits in a natural depression. In the circus area, the findings do not reflect the geophysical evidences at all. Here, the cores illustrate, that geophysical evidences (by magnetometry), that were analysed as a suburban workshop area, meant to be in a depth of about one meter, are in reality in 2–3 m depth. So the surface findings reflect the circus and the latest use of this intra urban area but not the workshops at all. The overall results of the non-invasive field research and detailed analysis of the findings will be presented in a forthcoming publication.

¹³ Groh, Schimmer, Donat 2016, 79–88.

- BASSO et al. 2024 = BASSO P., J. BONETTO, D. COTTICA, S. DILARIA, F. FONTANA, A. R. GHIOTTO, M. RUBINICH, C. TIUSSI, P. VENTURA 2024, Aquileia and its urban development in the light of recent and ongoing research. – In: Horvat, J., St. Groh, K. Strobel, M. Belak (eds.), *Roman urban landscape. Towns and minor settlements from Aquileia to the Danube*. – Opera Instituti Archaeologici Sloveniae 47, 2024, 53–76. (doi: https://doi.org/10.3986/9789610508281_03)
- BERTACCHI, L. 2003, *Nuova pianta archeologica di Aquileia*. – Udine.
- BONETTO et al. 2020 = BONETTO J., G. FURLAN, A.R. GHIOTTO, I. MISSAGLIA BONETTO 2020, Il canale Anfora e il centro urbano di Aquileia: osservazioni cronologiche alla luce di nuovi dati. – *Journal of Ancient Topography* XXX, 175–202.
- BUORA, M., V. ROBERTO 2010, New work on the plan of Aquileia based on aerial photographs and a GIS platform. – *Journal of Roman Archaeology* 23/1, 320–334.
- GROH, S., 2012, Research on the Urban and Suburban Topography of Aquileia. – *NTA-2012, Proceedings of the 2nd Workshop on The New Technologies for Aquileia*, Aquileia, Italy, June 25, 2012. (<https://ceur-ws.org/Vol-948/paper4.pdf>; last accessed 29 November 2023)
- GROH, S. 2013a, Ricerche sull'urbanistica e le fortificazioni tardoantiche e bizantine di Aquileia. Relazione sulle prospezioni geofisiche condotte nel 2011. – *Aquileia Nostra* 82/2011 (2013), 153–204.
- GROH, S. 2013b, Forschungen zur Urbanistik und spätantik-byzantinischen Fortifikation von Aquileia (Italien). Bericht über die geophysikalischen Prospektionen 2011. – *Jahreshefte des Österreichischen Archäologischen Instituts* 81/2012 (2013), 67–96.
- GROH, S. 2015, Prospezioni geofisiche nel territorio di Aquileia: una villa romana a San Canzian d'Isonzo (Gorizia, Italia). – *Jahreshefte des Österreichischen Archäologischen Instituts* 83/2014 (2015), 43–55.
- GROH, S. 2016: Nouvelles recherches sur le système fluvial et les installations portuaires d'Aquilée (Italie). – In: C. Sanchez, M.-P. Jézégou (eds.), *Les ports dans l'espace méditerranéen antique. Narbonne et les systèmes portuaires fluvio-lagunaires*, Revue Archéologique de Narbonnaise, Suppl. 44, 189–192, Montpellier-Lattes.
- GROH, S., M. BUORA 2018, Strutture di adduzione e di smaltimento dell'acqua nel settore meridionale di Aquileia. – In: M. Buora, S. Magnani (eds.), *I sistemi di smaltimento delle acque nel mondo antico*, Antichità Altoadriatiche 87, 95–98.
- GROH, S., F. SCHIMMER, P. DONAT 2016, *Forschungen im westlichen Suburbium von Aquileia. Erste Ergebnisse eines Surveys im Bereich des Westhafens*. – In: G. Grabherr, B. Kainrath (eds.), *Akten des 15. Österreichischen Archäologentages in Innsbruck*, 27. Februar–1. März 2014, IKARUS 9, 79–88, Innsbruck.

Stefan Groh
 Österreichisches Archäologisches Institut
 Österreichische Akademie der Wissenschaften
 Dominikanerbastei 16
 A-1010 Wien
 stefan.groh@oeaw.ac.at

