



ΑΝΘΡΩΠΟΣ

STUDIES OF THE ANCIENT WORLD

In Honour of Werner Jobst

8/2008

Trnavská univerzita v Trnave Filozofická fakulta

Universitas Tyrnaviensis Facultas Philosophica



ANODOS

Studies of the Ancient World

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8/2008

TRNAVA 2010

A N O D O S

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8/2008

Redakčná rada/Editors:

Prof. PhDr. Mária Novotná, DrSc., Prof. Dr. Werner Jobst, doc. PhDr. Marie Dufková, CSc., doc. PhDr. Klára Kuzmová, CSc.

Redakcia/Editorial Staff:

doc. PhDr. Klára Kuzmová, CSc., Mgr. Ivana Kvetánová, PhD.

Počítačová sadzba/Layout:

Zuzana Turzová

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Kontaktná adresa (príspevky, ďalšie informácie)/Contact address (contributions, further information):

✉ Katedra klasickej archeológie, Trnavská univerzita v Trnave, Hornopotočná 23, SK-918 43 Trnava
☎ +421-33-5939371; fax: +421-33-5939370
✉ klasarch@truni.sk

Publikované s finančnou podporou Ministerstva školstva SR (Projekty: KEGA č. 3/5105/07; VEGA č. 1/0408/09) a Pro Archaeologia Classica.

Published with financial support of the Ministry of Education of the Slovak Republic (Projects: KEGA No. 3/5105/07; VEGA No. 1/0408/09) and the Pro Archaeologia Classica.

Za znenie a obsah príspevkov zodpovedajú autori.

The authors are responsible for their contributions.

Tlač/Printed by: GUPRESS, s.r.o., Bratislava
z tlačových podkladov Filozofickej fakulty Trnavskej univerzity v Trnave

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ISBN 978-80-8082-384-9

Obálka/Cover:

Motív „Zázračného dažďa“ zo stĺpa Marka Aurélia v Ríme. V okienku: Vlys propylonu s tritonmi, Antiocheia v Pisidii (Foto I. H. Mert).

Motif of the „Miracle rain“ from the column of Marcus Aurelius in Rome. In the window: Frieze of propylon with Tritons, Antiocheia in Pisidia (Photo I. H. Mert).

Grafické spracovanie/Graphic elaboration: Mgr. Pavol Šima-Juríček

Počítačové spracovanie/Computer elaboration: PhDr. Ivan Kuzma

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The Değirmendere Aqueduct to Ephesus ¹

Gilbert Wiplinger ²

in collaboration with

Nicole Birkle, Gemma Jansen, Annette Nießner, Paul Kessener and Susanne Piras

Keywords: Ephesus, Değirmendere Aqueduct, New Results, Destruction, Safeguarding Measures

Abstract: During the pre-Roman and Roman era altogether six aqueducts brought water to Ephesus, the capital of the Province Asia. The oldest aqueduct was already built under King Lysimachus in the first half of the 3rd c. B.C. The only one kilometre long string of clayware pipes from Lysimachian times is one of the most important relicts of that era. The longest and youngest waterline to Ephesus is the 43 km long Değirmendere aqueduct which was erected in the middle of the second c. A.D. The longest part of the Değirmendere aqueduct lies within the boundaries of the area of Kuşadası. This aqueduct is the only building in Kuşadası dating back to Roman times. The city council as well as the inhabitants of Kuşadası should, therefore, regard it rather as a precious architectural gem, than leave it to decay and demolition or even vandalism as has happened so often during the last years. Here, I would like to introduce you to the newest research results as well as offer some guidance as to how to avoid such destruction.

From the spring to the Bahçecikboğaz Valley

The springs of the Değirmendere aqueduct lie in the east of Kuşadası on the way to Kirazlı village, so that the supply line with 20 aqueduct bridges and three tunnels – at first – is led towards the seashore in the west, from where it runs along steep slopes to the north until it crosses a valley parallel to the seashore and turns eastwards again (see for all place names on map, Fig. 1).³ As a result of the steep slopes, the supply system was constructed in a totally different manner than any of the other aqueducts of Ephesus: instead of levelling the rock down, the channel was mounted on high retaining walls, which were reinforced by mighty supporting pillars, sometimes with only very short intervals in between. At first, the water is led along a nearly vertical rock out of the gorge to cross a relatively flat ground for a while, where it runs over the more than 150 m long Başkemer aqueduct-bridge – actually a wall with 12 irregular openings –, which was still in use until recently. Just before this bridge, further water was fed from springs at the foot of the Keltepe hill. Then follow two tunnels⁴: the first, the Akrepli tunnel, of only a length of approx. 170 m, was intended to abbreviate the line around the Değirmenetepe hill, while the second, the so-called Kalafat tunnel is a great deal longer (about 800 m) and has the greater cross-section 70 x 210+x cm, which may imply that further water might have been brought along also between these tunnels, already before the Cumaakşam bridge – according to

¹ The present contribution is the paper version of a talk given by the author at the 2. Symposium of the Municipality of Kuşadası/Turkey: „Geçmişten Geleceğe Kuşadası“, on 6 November 2008. None of the papers presented at that occasion have ever been published. Since the person celebrating a jubilee has observed and supported the procedures and results of the Aqueduct Project, which was funded by the Austrian Academic Endowment Fund (Österreichischer Wissenschaftsfonds) since 2007 (FWF-Projekt Nr. P20034-G02), with great interest, it is my sincere wish to dedicate this important article containing the results of the undertakings of 2006 together with my colleagues to him. As we remember the productive and pleasant breakfast conversations at the excavation house at Ephesus, I and my colleagues wish him all the best for his future path of life.

² I want to thank Claudia Luxon for the translation.

³ Wiplinger 2006, 30-5; Forchheimer 1923, 228-33; Öziş et al. 2007.

⁴ Öziş et al. 2004, 293-300; Wiplinger 2006, 31.



Fig. 1. Map of the Değirmendere aqueduct with the names of the aqueduct bridges and tunnels.



Fig. 2. Bahçecikboğaz valley with the Değirmendere aqueduct.



Fig. 4. Sapudere aqueduct-bridge.



Fig. 3. Adamtoluboğaz aqueduct-bridge with an illicit excavation in the background.

only recently discovered evidence. The largest of all the 11 known entry-shafts in to the tunnel amounts to a height of about 26 m.

In 2003, we discovered three aqueduct bridges before *Kuşadası* on the way to *Çamlık*, of which the *Zincirlikuyu*- is virtually no longer preserved, the *Kocakelle*- shows two arches and the *Sabancık* aqueduct-bridge is about 270 m long (Fig. 1). After *Kuşadası*, where the aqueduct has been destroyed considerably through the comprehensive building work in the town, the line is preserved throughout until the city-limits of Ephesus. It reaches far into the *Bahçecikboğaz* valley (Fig. 2), which it crosses via the highest and formerly perhaps three-storey high aqueduct bridge.

The double aqueduct

We had already realised beforehand, that the line was built with double channels up to the saddle after the *Mercankuyu* aqueduct-bridge, whereby – with the exception of the two greater aqueduct bridges already mentioned - all the other bridge constructions (*Kırlangiç*-, *Bahçecikçeşme*-, *Adamtoluboğaz*- (Fig. 3), *Sapudere*- (Fig. 4), *Ceneviz*-, *Dilbalık*-, *Taşkesinti* aqueduct-bridge) have been built double next to each other. The reason for this double-line became evident in 2006 when the *Selçuk* museum discovered the *Mezarlık* tunnel in the critical saddle after the *Mercankuyu* bridge during a safeguarding excavation: the ancient construction work of such a long aqueduct not only made a workforce of several different gangs of a single company necessary, but also the employment of various other firms in order to fulfil many diverse tasks. The *Sapudere* aqueduct-bridge significantly shows what the bridge looked like before the channel was built later on top.

Presumably, one building firm was in charge of building the bridges themselves, while another firm was responsible for the substructures and supporting walls, a further company for the tunnels while finally a fourth firm built the actual channel on top or through the already completed constructed parts. Here, the builders only realised later, behind the *Mercankuyu* bridge, that the channel was about 1,90 m too low for being able to lead into the already completed *Mezarlık* tunnel. As this tunnel was already about 1 km long, it was decided not to rebuild the entire tunnel, but to erect a new conduit about 8 km in front of the tunnel by inserting a new flume into the old channel at the beginning of the section and only elevating the floor. As soon as the level difference increased considerably between both invertis (it became necessary to re-adjust the difference in altitude of 1,90 m by fitting in a continuously decreasing gradient) a new conduct was built facing uphill by re-using the old one as the foundation so that only the hill-side flank of the older channel was over-built. The older aqueduct actually was a channel with a cross section of 70 x 50 cm covered with stone slabs. The channel of the younger aqueduct is vaulted and has a cross-section of 65-95 x 235 cm (Fig. 5).

The older channel was presumably used during the building period of the younger one, as some sections not only display a complete *opus signinum* but also a thin layer of calc-sinter on top of it. The crude covers, however, appear in stark contrast to the fine exterior rendering and indicate that the old conduit only operated during the construction of the younger aqueduct and was only used in sections (Fig. 6). Indeed, the water was needed for drinking and cleaning as well as for preparing the mortar. This is why the covering slabs not only protected the water from being contaminated, but also served as working-platform during the construction of the younger channel. As one particular section revealed a considerable number of such covering slabs, while the next one showed none, it is likely that such slabs were used several times and transported from one section to the next. The decision to widen the cross-section of the new channel must have fallen concurrently with the building of the main channel; this points to the fact that the water demand must have had increased in the meantime.



Fig. 5. Supporting pillar 17 in section XI. Type II stands on a covering slab of the older *Değirmendere* line, of which the substructure of the base of duct is clearly visible. Above: wall type C of the younger line.



Fig. 6. Covering slab above the older line in section XI.

Types of masonry and quarries

Already the section between the *Adamzoluboğaz*- and the *Sapudere* bridge in the *Bahçecikboğaz* valley which was studied in 2006, revealed seven different types of masonry. Quarries found above and below the aqueduct testify that the type of masonry depended on the stone material obtained from the immediate surroundings. The most frequently appearing standard masonry (type A) showed a clear distinction between the substructure and the flume by a set-off. Both building units consist of a layer of broken stones which are separated from one another by levelling courses. Usually, one can find two layers of broken stones in the foundation structure which are each topped by a double levelling course with thin stone slabs, sometimes even four layers thick (Fig. 7). Another type of a masonry (B) is clearly discernible here, as it includes far more irregular quarry stones and –all the same - needs less, sometimes no more than one single levelling course. Furthermore, there is no set-off between the substructure and the flume here.

Another type of masonry (C) only appears between supporting pillars (Fig. 5). This masonry type C together with all the supporting pillars was used for repairing the younger channel which became necessary due to the weak subsurface. As a result, the aqueduct had to be newly built as well as enforced by supporting pillars. The new masonry is very irregular and trimmed partly on a large scale, whereby the mortar must have been pressed on to the walls with a round object which caused horizontal and superposed rills.

Type D appears only in one spot and is completely irregular, without any levelling courses and broken-up heavily. Type E actually is the same as masonry type B: the younger channel's lower areas of the flank looking to the valley (i.e.: above the capstone of the hillside flank of the older channel) show rough blocks protruding from the visible surface as well as gaping openings where these have broken-away. The protruding blocks are the remains of the covering slabs, which were cut off in that places and the gaping openings are the results of moving the covering slabs away.

The quarry found near the *Sapudere* bridge which is detectable just below the masonry type F, is of particular interest in connection with the different number of masonry types. Despite of the weathering it shows very smooth and regular fissures and points to a quarry which was used for making large slabs into regular coursed rubble ashlar which was used for masonry type F. A quarry for such building material lies above the outlet into a large arch consisting of blocks with breccia-like stones. This proves that the planners probably paid attention to the stone resources in the nearby area in order to make building material more easily available. As a matter of fact, we found quite a number of quarries in the immediate vicinity to the aqueduct which testify that the building material was obtainable from right next to the stretch. This also explains the large amount of the irregular masonry type A where the rubble needed to be levelled by layers of thin stone slabs – quite on the contrary to the regular masonry of type F which we have only discovered in one single spot until now.

The idea of obtaining building material from a nearby area is again a clear proof that - instead of following any fixed parameters - the Romans were flexible in applying available material in order to avoid logistically elaborate long transport routes.

Supporting pillars and outlets for rain water

Among the 27 supporting pillars of the section under inspection, there are also two different types: type I interlocks into the sluice of the former channel, as in the case of the supporting pillar 26 where the walled-off inner cross-section is clearly discernable (Fig. 8). When the supporting pillar was erected here, there were no covering slab found *in situ* as such slabs were no more necessary after the younger water channel had been put into operation; nevertheless, the slabs were surely useful for laying paths to control the aqueduct in wayless territory. Type II lies on the covering slab of the older channel and the cross-section of the older channel isn't walled up (Fig. 5).

In the section between the *Adamtoluboğaz*- and the *Sapudere* bridge, we were able to record 28 outlets that enabled the rain water to flow beneath the channels. While 18 of these outlets are

placed in the older, 10 belong to the younger channel. Two of these are clay pipes, all the others have a rectangular cross section with different dimensions ranging from 11 x 22 cm to 27 x 54 cm (Fig. 9).

Details

Among many other smaller details discovered during carefully studying the objects, I would like to highlight two which are an evidence of the human dimension of this massive construction: immediately after the *Adamtoluboğaz* bridge, you can find a footprint in the *opus signinum* at the base of the duct – probably by a clumsy workman who had trodden in to the fresh mortar in the last minute. At another spot, there is a central line in the most upper layer of the older channel's sub-structure of the duct which couldn't be found anywhere else – here, an uneasy apprentice had to draw the exact centre in order to be able to lay the side flanks or their roughcast on the centre of the sub-structure. Many of these results were only possible through studying the particular section in greatest detail.

From the Mezarlik Tunnel to town

After the saddle, the line crosses first with the *Arvalyaçeşme*-, and then with the 400 m long *Arvalya* aqueduct-bridge (the longest bridge of this aqueduct) a valley parallel to the seashore, in order to be ultimately led around a bend over the last *Arapdere* aqueduct-bridge onto the SW-slope of the *Bülbül Dağ*. Underneath a tower of the Hellenistic town wall, the line enters the city, where it reaches the NE-slope of the greater city mountain over the saddle of the so-called Paul's Prison from where it supplied the lower districts and a.o.: the *insulae* of the terrace houses 1 and 2, with water.

Directly next to the exit of the *Mercankuyu* aqueduct-bridge, a side-channel is led into the main channel, the cross-section of which is still discernable in the profile of the road nearby (70 x 170+x cm). The side-channel comes from the opposite direction to the bridge, in front of which it drops out of a height of 2 m on to a short section, which diverts the flowing direction into a right angle, so that it reaches a stone slab in the upper part of the main channel. Apart from the *Sarurenkli* aqueduct-bridge, no other remains of this water line have yet been found.

Destructions and the future of the aqueduct

All such detailed research of the *Değirmendere* aqueduct is of course only possible in places which still exist or have been preserved. *Kuşadası* has grown enormously during the



Fig. 7. Wall type A of the younger line.



Fig. 8. Supporting pillar 26 in section XI, type I which is built into the channel of the older line.



Fig. 9. Outlet 14 for rain water in the older line in section XI.

last 20 years. In the meantime, the dense building development above the by-pass road has already destroyed the entire length of the aqueduct in that area. An approximately 300 m long section of the *Değirmendere* aqueduct was removed for the sake of widening the road from *Selçuk* to *Kuşadası* in 2005. Repeatedly we discover traces of illicit excavations as for instance in the case of the *Adamtoluboğaz* bridge where at first a great breach was beaten into the wall and the substructure, and then an enormous pit was dug so deep that the bridge's static equilibrium was disrupted so much that further damage will appear if the gap isn't filled very soon (Fig. 3).

2008, the *Akrepli* tunnel was wilfully destroyed by the municipality of *Kuşadası* because one of the concrete pipes had blasted carrying water from the spring at the foot of the *Keltepe* hill to *Kuşadası* until today. Due to the fact that the tunnel is so narrow and not easily accessible, caterpillars drilled three huge craters into the landscape in order to finally discover the leak but thereby irreversibly destroying the remains of the tunnel completely.⁵ Then, instead of rebuilding the

tunnel in the demolished areas as demanded by an official notification of the İzmir Commission for the Preservation of Monuments, the huge pits were merely filled-up with earth without even safeguarding the sites of fracture. This is why the tunnel today is completely filled with earth so that any academic study is only possible through laborious and costly diggings - and that only in a few sections.

Through agricultural activities such as ploughing, crops and irrigations in the immediately adjacent fields and gardens, the remains of the *Değirmendere* aqueduct are being continuously destroyed until this day. Property owners in the *Bahçecikboğaz* valley fence their lots of land right up to the fundamentals of the aqueduct thereby using the channel-walls as a basis for their fencing pillars. In some spots, the foundations for a power pole was superimposed right on top of the aqueduct and even destroyed it.

At the *Sapudere* bridge, a farmer seems to repeatedly deposit rubble and old objects. In 2006, we cleaned the entire area around the bridge for making photographs and stacked the rubble up further away. One year later, however, even more rubble had been brought along and distributed all around the area. The list of damages and disfigurements of the *Değirmendere* aqueduct can be perpetuated.

Lets have an end to it and also the amount of damage needs to stop because the only Roman construction in the municipality of *Kuşadası* would soon be totally destroyed. Every one of us can contribute in preserving this building by treating the Roman aqueduct to Ephesus like a precious gem. My colleagues' and my own contribution is the academic study, documentation and publication of all the aqueducts leading to Ephesus. The academic research results focusing on the *Değirmendere* aqueduct will finally be published in the series „Forschungen in Ephesos“.

⁵ Şenol Eskin reports on this in: Eskin 2008.

It must be your contribution to save this piece of cultural heritage from any further destruction. Here, the head of the district office and the Mayor have the most possibilities, as they are able to enforce any measure of safeguarding through the laws and regulations that already exist on a national level. Yet, every one of you, be it an owner of a property along the aqueduct or only somebody strolling around a lovely landscape, can make sure that nobody further damages the aqueduct or its surroundings by pollution.

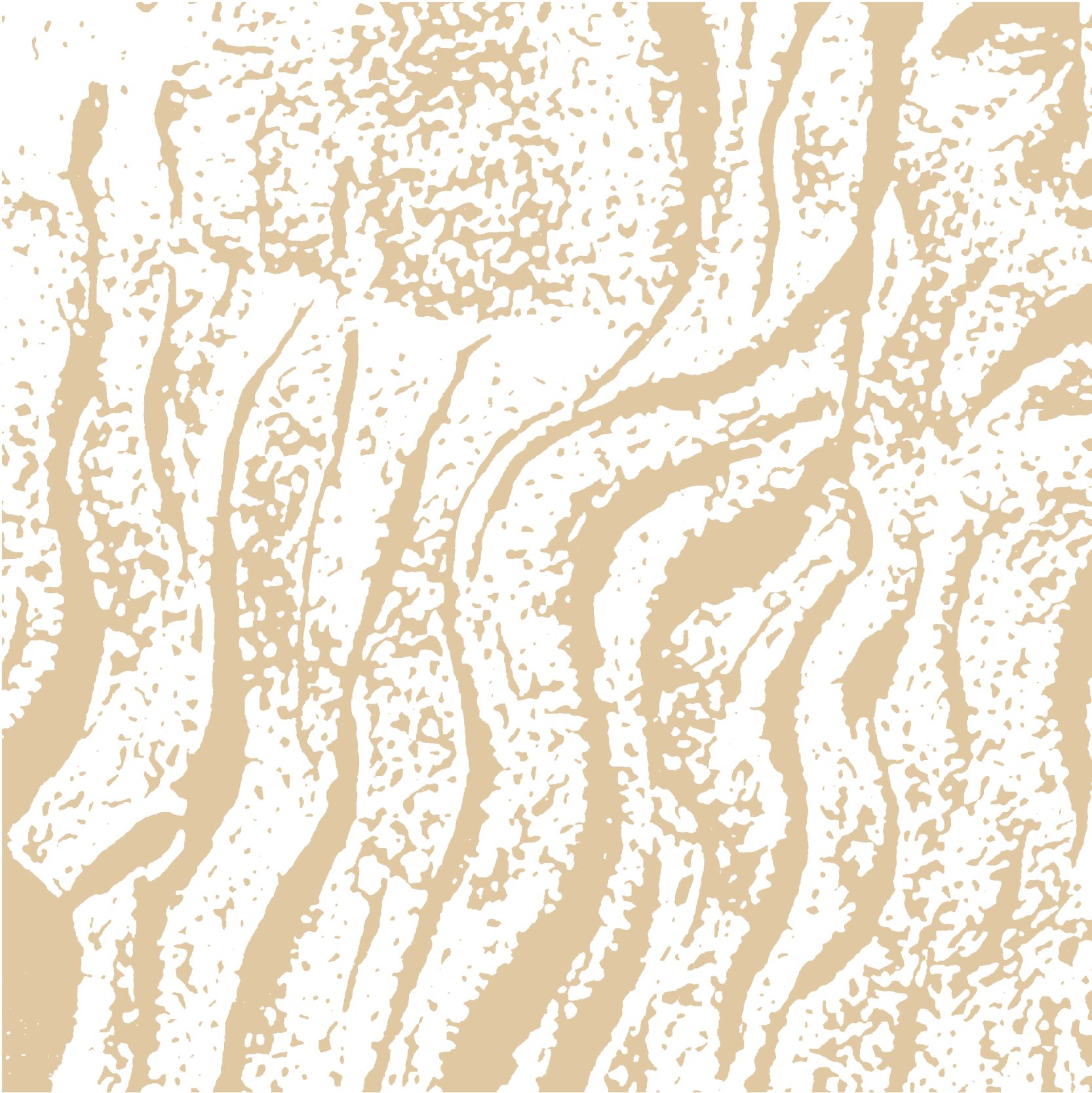
While we are working on the research and publication, we will also prepare a conservation project for the *Değirmendere* aqueduct with the aim to maintain the relicts for ensuing ages. For this, urgent safeguarding will need to be carried out so that the individual buildings no longer fall into decay – by for instance repairing the damages caused by illicit excavations at the *Adamtoluboğaz* bridge. Moreover, also reconstructions of aqueduct bridges ought to be considered.

Finally, at the end of this work, a hiking trail could lead along the *Değirmendere* aqueduct through the wonderful nature of *Kuşadası*, thereby winning the attention of a new public and stream of visitors. These ways will enable visitors to walk along the entire aqueduct, starting with a fantastic topographical view way above the *Değirmendere* spring in the saddle of the road between *Kuşadası* und *Kirazlı*, then, following the terrain over the two tunnels and aqueduct bridges until the town where a particular attraction – the sightseeing of the Ottoman *Büyükkemer* aqueduct-bridge and the caravanserai – leads to the tranquil and impressive landscape of the *Bahçecikboğaz* valley. From there, via aqueduct bridges high above the seashore, the hiker would reach the saddle with the *Mezarlık* tunnel and then, via the *Arwalya* with its bridges and crossing the *Arapdere* valley, the *Bülbül Dağ*. Passing by the tower of the city wall below which the aqueduct originally passed through, the visitor would enter the urban area of Ephesus. It is a really fantastic tour through the beautiful landscape around *Kuşadası* and the town itself, and is topped by a sublime feeling of entering the ancient city by the way of water, as this introduces the hiker to the entire topography of Ephesus and its surroundings. The walking route should also include several rest stops with explanation panels in addition to offering refreshments and meals.

Dipl. Ing. Gilbert Wiplinger
Österreichisches Archäologisches Institut
Franz Klein Gasse 1
A-1190 Wien
gilbert.wiplinger@oeai.at

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ISBN 978-80-8082-384-9