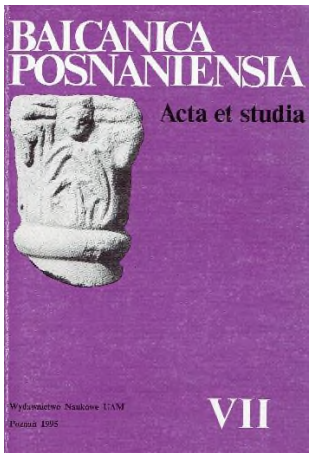


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Zadanie zostało zrealizowane w ramach konkursu „Społeczna odpowiedzialność nauki II – Wsparcie dla bibliotek naukowych". Projekt zatytułowany „Digitalizacja archiwalnych wydań czasopism naukowych zgromadzonych przez Bibliotekę Coll. Historicum UAM". Projekt dofinansowany ze środków budżetu państwa, przyznanych przez Ministra Nauki w ramach Programu Społeczna odpowiedzialność nauki II. Wsparcie dla bibliotek naukowych (umowa nr BIBL/SP/0092/2024/02 z dnia 05.12.2024). Całkowita wartość projektu: 247 236,00 zł. Kwota dofinansowania: 220 836,00 zł.

The task was carried out within the framework of the competition "Social Responsibility of Science II – Support for Scientific Libraries". The project entitled "Digitization of archival editions of scientific journals collected by the Library of the Coll. Historicum of Adam Mickiewicz University". The project was co-financed from state budget funds granted by the Minister of Science within the framework of the Programme Social Responsibility of Science II. Support for Scientific Libraries (agreement no. BIBL/SP/0092/2024/02 of 05.12.2024).
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UAM Poznań 1995

*Belisarii Velkovi*
*memoriae dicatum*

# RATIARIA (MOESIA SUPERIOR) AND ITS WATER SUPPLY

DARIO GIORGETTI

ABSTRACT. Giorgetti Dario, *Ratiaria (Moesia Superior) and its water supply*. Balcanica Posnaniensia. Acta et studia, VII, Adam Mickiewicz University Press, Poznań 1995, pp. 243-249. 5 Figs. ISBN 83-232-0617-1. ISSN 0239-4278. Text in English.

In this article the author deals with the problem of drinking water supply of Ratiaria in light of the recent Italian-Bulgarian archaeological studies in this centre.

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In the summer of 1978 the common Bulgarian-Italian researches have begun on the place of the Roman settlement of Ratiaria, colony of Trajanic age founded, most likely, in the interval between the two Dacian wars on the Danubian front, at the NW boundary of the Province *Moesia Superior*[1] (Fig. 1).

In the year 275, after the loss of Dacia and the withdrawal of the limes on the right bank of the Danube, with a new re-establishment of the political and military Roman forces along the Danubian line, from Viminacium to Durostorum, Ratiaria became a chief town of the new Province of *Dacia Ripensis* and seat of the *Legio XIII Gemina*, here transferred from Apulum.[2]

The remains brought to light till today and the epigraphical, funerary or sporadic discoveries, show clearly that the greatest economic prosperity belongs to the period between the Antoninian and Severian age, while a real demographic explosion may be placed (located) between 3rd and 5th centuries with the progressive and ever-increasing fitting in and medley of autochthonous and barbarian elements into the ratiariensis society, of old Italic

[1] V. Velkov, *Ratiaria: eine römische Stadt in Bulgarien*, Eirene V (1966), pp. 155-175 (= idem, *Roman cities in Bulgaria. Collected Studies*, Amsterdam 1980, pp. 61-83).

[2] F. Vittinghoff, *Die Bedeutung der Legionslager für die Entstehung der römischer Städte an der Donau und in Dakien. Studien zur europäischen Vor- u. Frühgeschichte* (=Festschr. H. Jankuhn), Neumünster 1968; V. Velkov, *Cities in Thrace and Dacia in Late Antiquity*, Amsterdam 1977.

origin; so it seems to me more clear that the passage μεγίστη καὶ πολυανθρωπος used from Priscus in his description of Ratiaria during the Hunnic invasion in the middle of 5th c. The town, may have suffered heavy damages during that crucial situation, but surely was not destroyed; on the contrary it was used by Attila and his leutenant Onegesius as a basis for the Hunnic forces and the ransom negotiations of civil prisoners.[3]

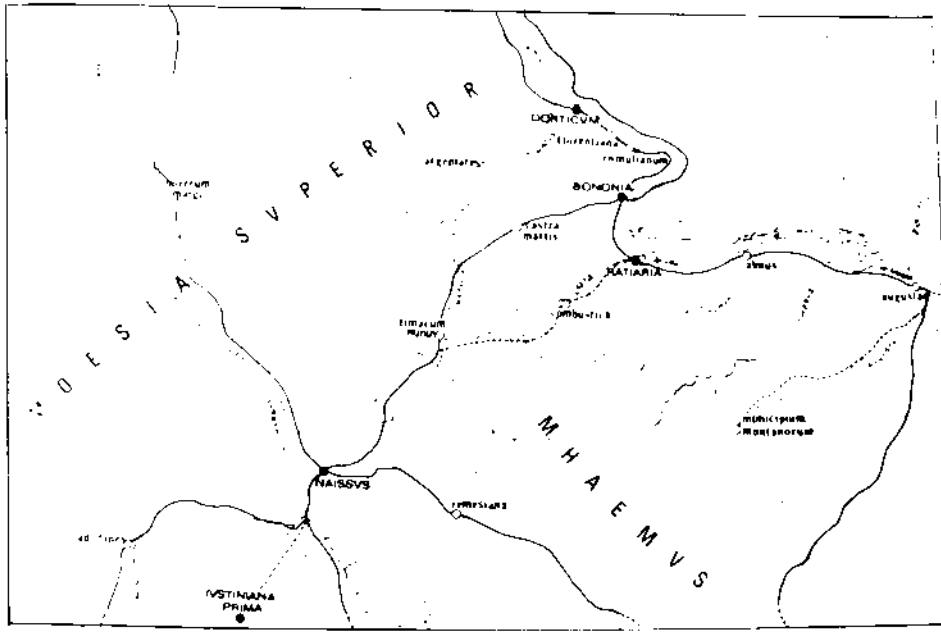


Fig. 1. Map of Moesia Superior in the 2nd century A.D.

The real fall of Ratiaria, as a Roman-Byzantine town, happened probably in the year 586 during the Avaric invasion, but the existence of late, poor, underdone pottery, chiefly amphoras and ollas with decorated shoulders, shows an almost immediate reoccupation of the site by Slavic peoples during the 7th c.[4]

We know already the particular geological structure of the site chosen by the Romans for their first military garrison, probably still in Flavian age, and

[3] D. Giorgetti, *Colonia Ulpia Traiana Ratiaria: analecta geographica et historica*, Ratiariensia I, Bologna 1980, pp. 13-34; F. Martelli, *Linee dell'evoluzione sociale e politica di Ratiaria e dell'area danubiana*, ibidem, pp. 35-64. Within administrative problems see, last, D. Giorgetti, *Vicus Cariscus, un residuo toponomastico per la suddivisione amministrativa di Ratiaria*, in "Simblos". Scritti di Storia antica, Bologna 1994.

[4] G. A. Mansuelli, *Il limes bassodanubiano in età tardo-antica. Note di geografia storica*. Ratiariensia II, Bologna 1984, pp. 13-36; F. Martelli, *La fine di Ratiaria in Teofilatto Symocatta*, ibidem, pp. 123-126.

Fig. 2. Foundation remains of the upper aqueduct (*specus* model)

where, later, the Trajan colony was founded: a narrow and steeply rising plateau, on the south bank of the Danube, as high as 50 up to 60 m on the Black Sea level (about 40 m on the Danube level in this point). The low valley of Archariza stream, a little tributary of the Danube, flowing into the larger river after circumventing the southern and eastern sectors of the site, rendered the place easily defended on three sides.[5]

Proceeding now to archaeological and topographical subjects I should here remember the three main objects which have shaped the Italian cooperation to

[5] D. Giorgetti, *Ratiaria and its territory*, Ancient Bulgaria (Papers presented to the Intern. Symp. on the Ancient History and Archaeology of Bulgaria), II, Nottingham 1983, pp. 19-39. Id. *Res ad topographiam veteris urbis Ratiariae pertinentes: prolegomeni all'urbanistica della città romana*, in "Ratiariensia", III-IV (1987), pp. 33-84.


Fig. 3. Hadrianic brick stamp (negative)

Fig. 4. Second aqueduct (terracotta pipes)

the researches of Ratiaria: the test-dig in place Iliata, with stimulating results which confirm, on the whole, the historical chronology accepted for Ratiaria till today; the localisation of the ancient quarries; the study on the town water supplies; of this last I would here offer you some valuations.

The aqueduct which supplied the Roman colony came from the springs placed on the high ground of Zidovec, 4 miles as the crow flies SW of Ratiaria; running towards the town it had to pass over the deep depression of the stream Archariza, in place D'rgianiza.[6]

Here the test-digs positioned on the high left quay of the Archariza have brought to light a double parallel line of aqueducts: the first, upper and main (Fig. 2), probably of Hadrianic age as some brick stamps here found suggest (Fig. 3), was built following the *specus* model; of this only the foundations remain, a large base of concrete over which the sliding water plan runs made of three parallel lines of square tiles, while the covering was probably ogival or with a barrel vault.

The second line was built only from terracotta pipes (Fig. 4), each one of about 50 cm in length with an inside diameter of 24 cm, well joined one after the other with the classic male-female system and the meeting point sealed with thick hydraulic mortar (Fig. 5). This parallel subdidiary line runs 4 m lower of the main at the distance of 6,50 m. I didn't find, till today, any trace of this line

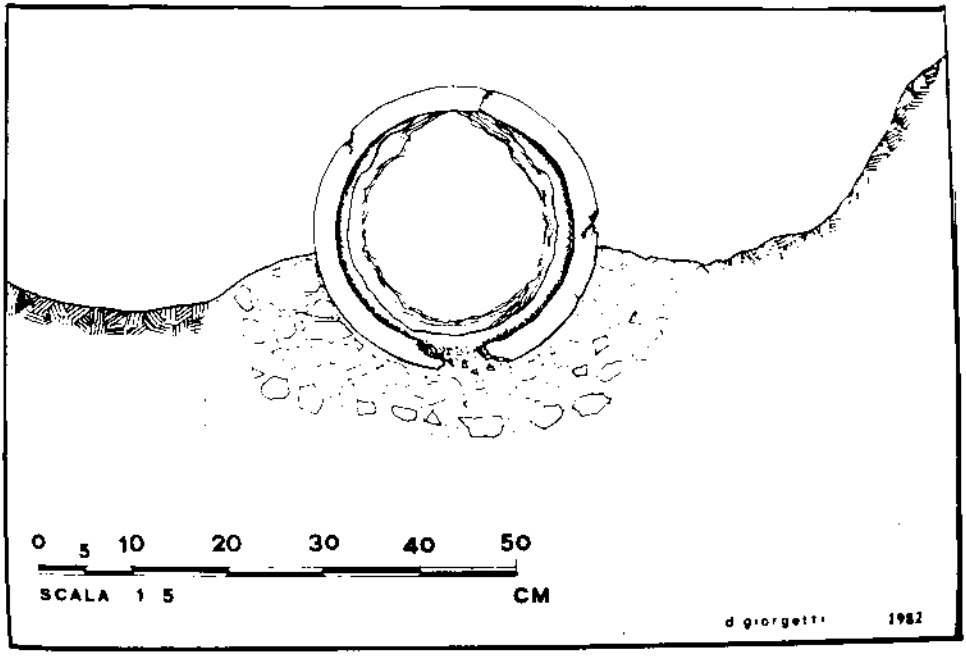


Fig. 5. Terracotta pipe: drawing of the meeting point

[6] J. Atanasova, *La conduite d'eau de la ville de Ratiaria*, Ratiariensia I, 1980, p. 83 sgg.

in terracotta pipes on the hill along the right bank of the Archariza; it lies only on the left one.[7] This circumstance may have, in my opinion, the following technical explanation: the aqueduct arrives from Židovec on the right bank of the Archariza at a rather high altitude, compared to the stream level, so, for passing over it, might be reckoned and built one progressive down-grade following the step-system like, giving some examples, the hydraulic stair of the Yzeron aqueduct, near Recret, in the neighbour of Grezieu-la Varenne, or that of Montjeu at Autun (Augustudunum).[8]

Here too the aqueduct had to pass over a depression with a considerable gradient of 8% while, in our situation, the slope of the hills on the two sides of the Archariza stream is still stronger, rising over 20%.

We know that the medium gradient in the Roman aqueducts, according to several measurements effected till today, is one per thousand; so in these circumstances, like in several others well known, there had to be built a system for breaking an excessive slope and holding a steady flow.[9]

In the situation of Yzeron was built a hydraulic stair system with the addition of some shafts for checking the waterfall.

The same system was used in the Ratiarian aqueduct too, because on the right bank of Archariza there are still visible the remains of the main line, sloping down step by step almost till the stream level, passing surely over it with low arches with a ventilating and breaking shaft in the middle of the *venter*.

At this point a siphonage system of terracotta pipes had to be built with which the flow climbed up to the level foreseen on the high left bank inside a recall shaft; it is so for this reason that we notice the subsidiary terracotta pipe-line only on the left bank in addition to the scanty efficiency of the main one.

From D'rgianiza the double line ran at level towards the town reaching near the western Gate (here the highest point) flowing into a *castellum aquae* of which the Bulgarian colleagues have brought to light the remains, next to the western boundary walls. From here more lines of lead *fistulae* and terracotta pipes brought water to the town. Thinking now to the medium gradient of one per thousand and, by means of Darcy's formula for the terracotta pipes, and those of Chezy-Tadini or Bazin for the *specus*, I have still proposed in the 2nd volume of "Ratiariensia", edited by our University in 1984, the hypothesis of a maximum flow of about 27. 000 cubic metres for both the lines. Applying

[7] D. Giorgetti, *Appunti per un rilevamento archeologico nel territorio di Ratiaria: le cave e l'acquedotto di D'rgianiza*, Ratiariensia II, p. 91 sgg.

[8] J. Burdy-H. Bougnol-A. Hernoud, *L'escalier hydraulique de l'aqueduc de l'Yzeron*, L'Araire (Bull. Groupe de recherche sur l'histoire et le folklore de l'ouest lyonnaise), n° 53 (1983), p. 29 sgg.; H. de Foutenay, *Autun et ses monuments*, Autun 1889, pp. 96-106.

[9] A. Trevor Hodge, *Siphons in Roman Aqueducts*, PBSR LI (1983), pp. 174-221; R. Tölle-Kasterbein, *Antike Wasserkultur*, München 1990, pp. 75-105.

now an acceptable leak coefficient of one in four we get a daily flow of about 20.000 cubic metres, it means 482 *quinariae* (I remember that Frontinus estimates, also if for the longest aqueducts of Rome, a leak coefficient, at the most, of 40%).

We may again think that of these 20.000 cubic metres 40% were destined to thermal uses and the 60% were sent to the public fountains and to the privates fountains; it means 8000 $m^3$ (192 *quinariae*) for specific use and 12 000 $m^3$ (290 *quinariae*) for the townspeople.

At least if we apply again to this last figure the daily coefficient of 0,60 m *pro capite*, or rather 600 litres of daily flow, which we know in the circumstances of Rome, Pompeii and lately of Bologna itself,[10] we obtain the hypothetical result that the water supply of Ratiaria was sufficient, in the maximum efficiency, at the end of the 2nd c., to the requirement of about 20.000 persons: a number of inhabitants which, perhaps, Ratiaria and its hinterland should reach at the time of Priscus.

In any case the double aqueduct line shows clearly that the average of water supply at Ratiaria between II and V c. was in accordance with the needs of a town of extensive proportions as well as the historical sources of the 5th Century let us understand.

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[10] D. Giorgetti, *L'acquedotto romano di Bologna: l'antico cunicolo ed i sistemi di avanzamento in cavo cieco*, Acquedotto 2000 (Bologna, l'acqua del duemila ha duemila anni), Bologna 1985, pp. 37-107 (see pp. 97-100); idem, *Die unterirdische Wasserleitung von Bologna*, in: *Wasserversorgung in der Antike*, Wien 1986.