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MOVING THROUGH MEDIEVAL MACEDONIA LATE MODERN CARTOGRAPHY, ARCHIVE MATERIAL, AND HYDROGRAPHIC DATA USED FOR THE REGRESSIVE MODELLING OF TRANSPORTATION NETWORKS*

Since the year 2008 I have been trying to look for new ways of approaching the historical geography of the Byzantine Empire¹. Some aspects which I had originally envisaged, could not be fulfilled due to the structure of the sources and the data within the disciplines of Byzantine and South-East European Studies. Other aims have been successfully accomplished since then, for example my professorial dissertation (Habilitation)².

With this article I would like to enter a new phase of my scholarly research³, which will probably sound familiar to *Geographic Information System (GIS)* – technicians, geographers, cartographers and related academic disciplines, but which is not familiar to many historians or even some archaeologists. Herein I would like to show how historians can make use of different layers of data deriving from different periods of time – that is from the 11th to the 21st century – in order to intertwine a specific part of the Macedonian transportation network with hydrographic data and thus reconstruct the landscape of past times.

The starting point of my article is the renowned *Via Egnatia*, which connected West and East, that is the Albanian coast and Constantinople. While a vast bibliography exists on its history and on its course⁴, we still lack fundamental research on some of its sections.

* This scholarly research was funded by the Adolf Holzhausen Legat of the Austrian Academy of Sciences.

¹ Cf. on the publications of the author: <http://oeaw.academia.edu/MihailoPopovic> [27 VII 2012].

² M.St. POPOVIĆ, *Von den Quellen zum Visuellen in der historischen Geographie. Zentrale Orte, Siedlungstheorien und Geoinformatik, angewendet auf die historische Landschaft Makedonien (13. bis 16. Jahrhundert)*, Wien 2013 (in press).

³ One of the pioneers in this field from the viewpoint of Byzantine Studies is Jacques Lefort with his ground-breaking study: J. LEFORT, *Les niveaux du lac de Nicée au Moyen Âge*, [in:] *Société rurale et histoire du paysage à Byzance*, Paris 2006, p. 375–393 [Bilans de recherche, 1].

⁴ Cf. the following selection of studies on the *Via Egnatia* with further bibliography: A. AVRAMEA, *Land and Sea Communications, Fourth–Fifteenth Centuries*, [in:] *The Economic History of Byzantium*.

Let me draw your attention to one of these sections in order to illustrate the interdependency of road and hydrography, of land and water. My article is concerned with the *Via Egnatia* between Bitola in the Former Yugoslav Republic of Macedonia (FYROM) and Edessa in Greece and especially with its course in the vicinity of as well as around Lake Vegorititis (cf. *fig. 1*).

The Roman road map *Tabula Peutingeriana* sketches one *mansio* called *Cellis* between Bitola and Edessa⁵, which is identified with the remnants of a fortified settlement on an elevation called *Gradista*, 1.5 km west-south-west of the village of Petrai⁶.

In conjunction with archaeological finds it becomes obvious that the *Via Egnatia* traversed the pass of *Killi Dirven* (or *Kirli Derven*), where four milestones have been found, circumvented Lake Petron from the south and reached the vil-

From the Seventh through the Fifteenth Century, ed. A.E. LAIOU, vol. I, Washington 2002, p. 57–90; В. БИТРАКОВА-ГРОЗДАНОВА, *Via Egnatia помеѓу Lychnidos u Pons Servilii (Нови археолошки докази)*, [in:] *Макропроект “Историја на културата на Македонија”. Археолошките откритија на почвата на Македонија*, Скопје 2008, p. 529–540 [= ПИИКПМ, 18]; P. COLLART, *Une réfection de la Via Egnatia sous Trajan*, BCH 59, 1935, p. 395–413; IDEM, *Les milliaires de la Via Egnatia*, BCH 100, 1976, p. 177–200; M. FASOLO, *La Via Egnatia I. Da Apollonia e Dyrrachium ad Herakleia Lynkestidos (Viae Publicae Romanae I)*, Roma 2005; IDEM, *La via Egnatia nel territorio della Repubblica di Macedonia*, [in:] *Παλαιά Φιλία. Studi di topografia antica in onore di Giovanni Uggeri*, ed. C. MARANGIO, G. LAUDIZI, Galatina 2009, p. 601–612; Т. ФИЛИПОСКИ, *Прашањето за проодноста на западниот дел од патот Via Egnatia (Драч–Солун) во втората половина на IX век*, [in:] *Пътуванията в средновековна България*, ed. В. ГЮЗЕЛЕВ et al., Велико Търново 2008, p. 110–119; L. GUNAROPULU, M.B. CHATZOPULOS, *Les milliaires de la voie égnatienne entre Héraclée des Lyncestes et Thessalonique*, Athènes 1985; N. G.L. HAMMOND, *The Western Part of the Via Egnatia*, JRS 64, 1974, p. 185–194; E. КОУТЧЕВА, *Civitates et Castra on Via Militaris and Via Egnatia: Early Crusaders’ View*, RESEE 44.1–4, 2006, p. 139–144; В. ЛИЛЧИК, *Античка патна мрежа*, [in:] *Археолошка карта на Република Македонија*, ed. Д. КОЦО, vol. I, Скопје 1994, p. 113–114; IDEM, *Via Egnatia Лихнид – Ресен*, [in:] *Макропроект...*, p. 541–550; IDEM, *Via Egnatia in the Republic of Macedonia*, [in:] *Via Egnatia Revisited. Common Past, Common Future. Proceedings VEF Conference, Bitola, February 2009*, Driebergen 2010, p. 24–32; Γ.Α. ΛΩΛΟΣ, *Via Egnatia / Εγνατία οδός*, Αθήνα 2008; R. MURPHEY, *Patterns of Trade along the Via Egnatia in the 17th Century*, [in:] *The Via Egnatia under Ottoman Rule (1380–1699). Halcyon Days in Crete II. A Symposium Held in Rethymnon, 9–11 January 1994*, ed. E.A. ZACHARIADOU, Rethymnon 1996, p. 171–191; Κ.Π. ΜΟΥΣΤΑΚΑΣ, *Το οδικό δίκτυο της Δυτικής Μακεδονίας κατά το Μεσαίωνα (11ος–15ος αιώνας)*, [in:] *Historical Geography. Roads and Crossroads of the Balkans from Antiquity to the European Union*, ed. E.P. DIMITRIADIS, A.Ph. LAGOPOULOS, G. TSOTSOS, Thessaloniki 1998, p. 145–154; M. NYSTAZOPOULOU-PÉLÉKIDOU, *Le réseau routier du Sud-Est européen et son apport à l'évolution historique des peuples balkaniques au Moyen Âge*, [in:] *Arta istoriei, Istoria artei. Academicianul Răzvan Theodorescu la 65 de ani*, București 2004, p. 27–36; N.A. ΟΙΚΟΝΟΜΙΔΗΣ, *The Medieval Via Egnatia*, [in:] *The Via Egnatia...*, p. 9–16; M.St. ПОРОВИЋ, *Towards a Mathematical Evaluation of the Significance of the Via Egnatia within the Transport Network of the Historical Region of Macedonia*, [in:] *Proceedings of the Conference “Македонија низ вековите”*, Skopje (in press); Tr. STOIANOVICH, *A Route Type: the Via Egnatia under Ottoman Rule*, [in:] *The Via Egnatia...*, p. 203–216; Th.L.Fr. TAFEL, *De via militari Romanorum Egnatia qua Illyricum, Macedonia et Thracia iungebantur*, Tubingae 1842 [repr. London 1972].

⁵ *Tabula Peutingeriana. Codex Vindobonensis 324. Vollständige Faksimile-Ausgabe im Originalformat*, ed. E. WEBER, Graz 1976, section VII, 1.

⁶ Cf. on the localisation of *Cellis*: Γ.Α. ΛΩΛΟΣ, *op. cit.*, p. 72.

lage of Vegora. From Vegora the road followed the southern shore of Lake Vegorititis until the village of Farangion, where its traces have been found by archaeologists. From Farangion the *Via Egnatia* went in the north-eastern direction to the village of Peraia, where again its remnants could be seen, and finally it turned to the east following the course of today's railroad⁷.

Margaret Hasluck has shown in her article entitled *The Archaeological History of Lake Ostrovo in West Macedonia* from 1936 that the lake was very low in ancient times and therefore much smaller than today⁸. At a certain point in history the extension of Lake Vegorititis changed. We can neither trace nor describe the changes properly in numbers, because we lack vital hydrographic data from the Middle Ages.

What we can take into consideration is data deriving from Byzantine historiography and from maps of the 19th and 20th centuries, because it allows us to approach this specific research question from two angles, from a historical angle as well as from a regressive angle.

It seems that the course of the *Via Egnatia* around Lake Vegorititis changed at the latest in the Ottoman period. An Austrian map from 1848, which was designed by the *Generalquartiermeisterstab* in Vienna, shows clearly that the road passed at that time along the northern shore of the lake (cf. fig. 2). The rise of the water level of the lake led to the flooding of the ancient course of the *Via Egnatia* on the southern shore as has been outlined by Hasluck⁹.

Let us leave the question aside for the moment what the reasons for the rise of the water level could have been and let us first turn to the evidence we possess, namely the mediaeval Byzantine sources.

In the Byzantine sources Lake Vegorititis is given the name Ostrobos (Ὀστροβός)¹⁰. The region around the lake played an important role during the campaign of the Byzantine emperor Basil II the Bulgar Slayer at the beginning of the 11th century. His troops were operating in this area and devastated it in 1015–1016. In 1020 the homonymous village of Ostrobos was subordinate to the bishop of Moglena. The Normans under Bohemund I of Taranto tried to conquer the village in 1082, but were repulsed. It was disputed between the Epirote principality and the Empire of Nicea in the 13th century. The Epirote

⁷ *L. cit.* Also cf. P.A. ΜΑΚΚΑΥ, *The Route of the Via Egnatia around Lake Ostrovo*, [in:] *Ancient Macedonia II: Papers read at the Second International Symposium held in Thessaloniki, 19–24 August, 1973*, Thessaloniki 1977, p. 201–210; Γ.Π. ΤΣΟΥΣΟΣ, *Ιστορική γεωγραφία της δυτικής Μακεδονίας. Το οικιστικό δίκτυο 14ος–17ος αιώνας*, Θεσσαλονίκη 2011, p. 67–70.

⁸ M. HASLUCK, *The Archaeological History of Lake Ostrovo in West Macedonia*, GJ 88.5, 1936, p. 448–456. Also cf. ΕΑΔΕΜ, *A Historical Sketch of the Fluctuations of Lake Ostrovo in West Macedonia*, GJ 87.4, 1936, p. 338–347; ΕΑΔΕΜ, *Causes of the Fluctuations in Level of Lake Ostrovo, West Macedonia*, GJ 90.5, 1937, p. 446–457.

⁹ M. HASLUCK, *The Archaeological History...*, p. 448–456.

¹⁰ Cf. on the history of the region: V. ΚΡΑΒΑΡΙ, *Villes et villages de Macédoine occidentale*, Paris 1989, p. 309–310.

ruler Theodore Comnenus Ducas conquered the village of Ostrobos in 1246. In 1252 it was recaptured by the Nicean emperor John III Ducas Vatatzes and fell again into Epirote hands in 1257–1258. Finally, the Niceans took control of it in 1259. During the Byzantine civil war in the middle of the 14th century John VI Cantacuzenus was in control of Ostrobos. Since the neighbouring Edessa was conquered by the Ottomans in 1389, it may be assumed that the region of Ostrobos was incorporated into the Ottoman Empire roughly at the same time.

The toponym Ostrobos, which denotes the village as well as the lake, is self-explaining. It comes from the Slavonic word *ostrovъ* meaning ‘island’¹¹ and thus hints to the topographical situation in the Middle Ages and in the Early Modern period. Ostrobos was renamed into Arnissa in 1926¹², but today’s Arnissa does not cover the original core of the settlement Ostrobos. The old Ostrobos lay approximately 1 km to the west of today’s Arnissa on an elevation at the shore of the lake. On this elevation the remnants of a minaret and probably an enclosure can be discerned. The minaret dates to the 15th century and was described together with the village of Ostrobos by the Venetian traveller Lorenzo Bernardo in May 1591 as follows:

(...) e poi, poco dopo, il lago di Ostrova che fu da noi costeggiato per assai lungo giro fino al luogo di Ostrova, dove è cadilaggio. Ostrova è villa sopra il lago, il qual si prolunga assai, ma è di forma ristretta, e con molte ritorte rispetto ai colli. In mezzo la villa di Ostrova, si rileva un piccolo monticello di sasso dirupato, che ha in cima fabricata una moschea dove si potria fare una molto sicura fortezza, trovandovisi anche attorno l’acqua del lago. (...).¹³

The minaret was documented by Hasluck in the 1930s¹⁴ as well as by my colleague Peter Soustal in 1993 (cf. fig. 3 and fig. 4). Nowadays, the elevation does not form an island in the lake any more (cf. fig. 5). Originally it did as is attested by the famous Arab traveller al-Idrisi in the middle of the 12th century, who reports that *Ustrubu* (that is Ostrobos) is a settlement surrounded by a big lake¹⁵,

¹¹ Cf. on the word ‘ostrovъ’: L. SADNIK, R. AITZETMÜLLER, *Handwörterbuch zu den altkirchenslavischen Texten*, Heidelberg 1989, p. 79; M. VASMER, *Die Slaven in Griechenland*, Leipzig 1970, p. 95, 200.

¹² Χ.Π. ΣΥΜΕΩΝΙΔΗΣ, *Ετυμολογικό Λεξικό των Νεοελληνικών Οικωνομίων*, vol. I, Λευκωσία–Θεσσαλονίκη 2010, p. 293.

¹³ This travel account was edited by: *Viaggio a Costantinopoli di Sier Lorenzo Bernardo per l’arresto del Bailo Sier Girolamo Lippomano Cav. 1591 aprile*, ed. F. STEFANI, Venezia 1886 (cetera: BERNARDO), p. 30 [= MSDVSP.M, 4]. His other account on the state of the Ottoman Empire entitled *Relazione dell’Impero Ottomano* was published in: *Relazioni degli ambasciatori veneti al Senato, Serie III.^a – Volume II.^o*, ed. E. ALBÈRI, Firenze 1844, p. 321–426 [= RAVS, 6]. Cf. on Lorenzo Bernardo: St. YERASIMOS, *Les voyageurs dans l’Empire Ottoman (XIV^e–XVI^e siècles)*, Ankara 1991, p. 407–409 [= CSACLH.PSTH, 7(117)].

¹⁴ M. HASLUCK, *A Historical Sketch...*, p. 340–341, figs. 2 and 5.

¹⁵ Bulgarian translation by: Б. НЕДКОВ, *България и съседните ѝ земи през XII век според “Географията” на Идриси*, София 1960, p. 38–39; in French translation: H. BRESCH, A. NEF, *Idrisi. La première géographie de l’Occident*, Paris 1999, p. 404.

as well as by the Byzantine historian George Pachymeres in the second half of the 13th century, who uses the expression ἔλλιμνον νῆσον (that is ‘an island in the lake’) in connection with the settlement¹⁶.

The toponym Ostrobos mirrors the features of the Byzantine landscape and enables us to deduce that the water level has changed significantly since then. In Antiquity the course of the *Via Egnatia* implies a low water level of the lake, which seems to have risen in the Byzantine period forming an island and thus justifying the name of the village.

In the 1930s Hasluck documented the existence of an island and of an islet (cf. *fig. 5*) and stated:

If the islet was sometimes under water and sometimes above it, as nowadays, the island near Ostrovo was most probably sometimes an island and sometimes a peninsula¹⁷.

According to the photographs of my colleague Peter Soustal the islet was an islet in 1993 (cf. *fig. 6*), but a peninsula in 2005 (cf. *fig. 7*), which shows again the drastic difference in the water level of the lake during a time span covering only twelve years. The core of the settlement Ostrobos lay on the island, where the above-mentioned minaret is to be found.

Obviously during the transition from the Byzantine to the Ottoman period the water level of Lake Vegoritis continued to rise and led to a diversion of the *Via Egnatia* from the southern to the northern shore of the lake. An Austrian handbook on the military geography of Macedonia from 1886 shows exactly this course (cf. *fig. 8*) and states that the road had a breadth from 6 to 10 metres, was old and not well kept¹⁸.

When it was decided by the Ottoman authorities to build a railroad between Thessalonica and Monastir (Bitola) at the end of the 19th century, the layout of the track followed the road on the northern shore of Lake Vegoritis. A German syndicate built the railway with an overall length of 219 kilometres between 1890 and 1894¹⁹.

¹⁶ GEORGES PACHYMÉRÈS, *Relations historiques*, II, 11, ed. et trans. A. FAILLER, V. LAURENT, vol. I., *Livres I–III*, Paris 1984, p. 151.

¹⁷ M. HASLUCK, *The Archaeological History...*, p. 451. Lorenzo Bernardo has left a description of the islet in his account from 1591: (...) *Entro a questo lago, vi è una picciola isoletta vestita di varii arbori di bella vista.* (...) – BERNARDO, p. 30–31.

¹⁸ *Militär-Geographie. Macedonisches Becken mit dem albanesischen Küstengebiete. Mit 7 Tafeln und 6 Beilagen*, Wien 1886, p. 167.

¹⁹ S. AYDIN, *Selanik-Manastir demiryolu*, İstanbul 1999; V. ENGIN, *Rumeli Demiryolları*, İstanbul 1993; D. ZOGRAFSKI, *Die ökonomischen und strategischen Aspekte des Eisenbahnbaus in Makedonien bis zum Ende des Ersten Weltkrieges*, [in:] *Eisenbahnbau und Kapitalinteressen in den Beziehungen der österreichischen mit den südslawischen Ländern*, ed. R.G. PLASCHKA, A.M. DRABEK, B. ZAAR, Wien 1993, p. 169–189 [= VKGÖ, 19].

But the lake continued to rise reaching two peaks in 1916 during the Great War and in 1923 respectively. The original railroad from the 1890s, which ran at heights varying from 530.90 metres to 539.40 metres above sea-level, was submerged by the water in 1916 and the tracks had to be relocated by the Serbian and French troops to a higher level in order to maintain their only means of communication with the battlefields on Mount Kaimakchalan. In 1923 the Greek railway authorities had to rebuild the line some 16 metres above its original level because the water level of the lake reached the high-water mark of 540.88 metres above sea-level²⁰.

On the photograph in *fig. 9* dated to 1934 the embankment and the permanent way of the third railway line built by the Greek railway authorities appears in the lower right-hand corner [3], the rails of the second Serbian-French line occupy the middle distance [2], and the location of the first German-Ottoman line can be discerned close to the water's edge [1]²¹.

We also witness the remarkable fluctuations of the water level if we take a look at Austrian and German maps from the 19th and the beginning of the 20th centuries (cf. *fig. 10, fig. 11, fig. 12*)²². An additional approach, which I would like to deepen and test in the near future, is the georeferencing of these maps in order to compare the extension of Lake Vegoritis now and then (cf. *fig. 13, fig. 14, fig. 15*)²³.

The last point I would like to address at the end of this article is the question what the reasons of the rise of the water level could have been. Climate change could be the first and simplest explanation of all, but not necessarily the only and correct one.

Let us pay attention to a text passage of the Byzantine historian John Skylitzes from the 11th century²⁴. He reports how the Byzantine emperor Basil II besieged the fortress of Vodena (today Edessa):

This [scilicet Edessa] is a fortress located on a precipitous crag around which the waters of lake Ostrovos flow. They travel some way underground then surface again here²⁵.

²⁰ M. HASLUCK, *A Historical Sketch...*, p. 339.

²¹ *Ibidem*, p. 340–341, *fig. 8*.

²² The figures 10, 11 and 12 illustrate how the island with the above-mentioned minaret appears and disappears on the maps in accordance with the fluctuations of the water level. The question if these differences could rather be connected to a generalisation in the mapping process, will be addressed thoroughly through the comparison of cartographic data in the course of future research by the author. For the time being the author does not find this option very probable based on his experience so far.

²³ Today the surface of Lake Vegoritis equals 72.5 square kilometres. Cf. Γ.Π. ΤΣΟΤΣΟΣ, *op. cit.*, p. 67–68.

²⁴ *Ioannis Scylitzae Synopsis Historiarum*, ed. I. THURN, Berolini–Novi Eboraci 1973, p. 345 [= CFHB, 5].

²⁵ English translation in: J. WORTLEY, *John Skylitzes. A Synopsis of Byzantine History, 811–1057*, Cambridge 2010, p. 327.

Skylitzes refers to a phenomenon which is called *καταβόθρα* in Greek or ‘underground channel’ in English. It was established in the course of the 20th century that the Lakes Petron and Vegoritis are linked to each other through underground channels. The level of any lake drained by these channels is apt to vary, not only because the quantity of water sent down the channels differs with the seasons, but also because the capacity of the channels, and consequently their outflow, is constantly changing²⁶.

This means that the water levels of the Lakes Petron and Vegoritis change because of the blocking or unblocking of these underground channels. Blocking occurs for example by mud or debris. The same kind of underground linkage was found between the Lakes Ohrid and Great Prespa.

This is precisely the direction in which my scholarly research points in the near future. I will focus on eight lakes in the southern Balkan peninsula (cf. *fig. 16*) – namely Lake Ohrid, the Great Prespa Lake, the Small Prespa Lake, Lake Petron, Lake Vegoritis, Lake Dojran, Lake Kerkini and the vanished Lake Achianos, which lay on the Thessalonica Front (Macedonian Front) between 1915 and 1918²⁷ and on which hydrographic data was gathered before, during and shortly after the Great War.

By combining Byzantine and Ottoman sources, travel literature, maps, archaeological evidence and hydrographic data I venture to compare different water basins, to discern their impact on the transportation networks through time and thus to reconstruct the landscapes of past times.

Abstract. The aim of this article is to illustrate how the rich data which was gathered during the scholarly work on *Macedonia, Southern Part* (Tabula Imperii Byzantini, 11) as well as on *Macedonia, Northern Part* (Tabula Imperii Byzantini, 16) from 2002 until 2010 can be combined with applications deriving from *Historical Geographic Information System (HGIS)* in order to create a case study on the transportation network and on the hydrography of Lake Vegoritis in the historical region of Macedonia.

For this reason a holistic approach combining humanities and natural sciences is applied, which comprises not only written medieval sources, which have already been evaluated in the bibliography, but also late modern datasets. Their undisputable value lies in the fact that they convey the state of the respective landscapes before industrialisation commenced in South-East Europe.

In the near future the author will expand his research in order to cover eight lakes in the southern Balkan peninsula – namely Lake Ohrid, the Great Prespa Lake, the Small Prespa Lake, Lake Petron, Lake Vegoritis, Lake Dojran, Lake Kerkini and the vanished Lake Achianos, which

²⁶ M. HASLUCK, *Causes...*, p. 447–450.

²⁷ Cf. on the Thessalonica Front for example: C. FALLS, A.F. БЕККЕ, *Military Operations Macedonia from the Outbreak of War to the Spring of 1917*, London 1933 [repr. Nashville 1996]; ИДЕМ, *Military Operations Macedonia from the Spring of 1917 to the End of the War*, London 1935 [repr. Nashville 1996]; R.C. HALL, *Balkan Breakthrough. The Battle of Dobro Pole 1918*, Bloomington 2010; А. Стојчев, *Дојран 1915–1918 (Воени операции)*, Скопје 2007.

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Fig. 1. Lake Vegoritits and its vicinity (Mihailo St. Popović)

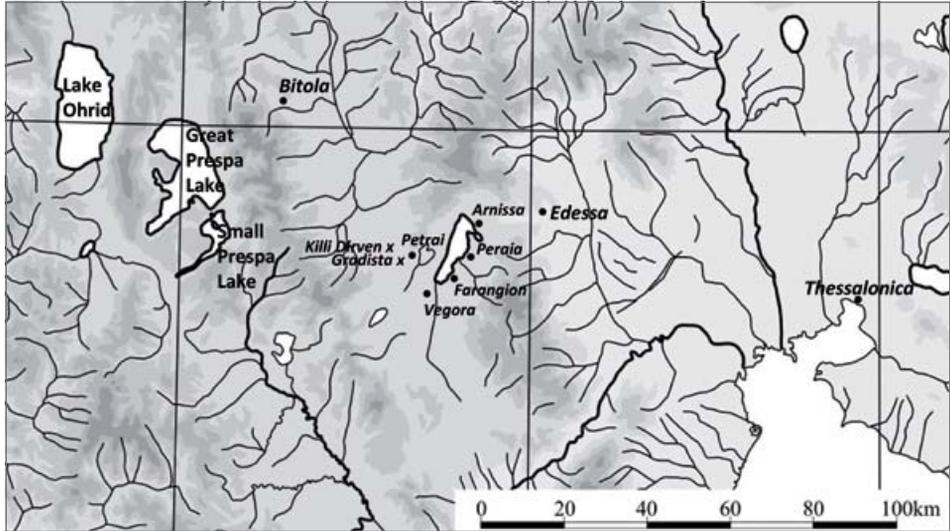


Fig. 2. Generalquartiermeisterstab Marschroutenkarte Europa 1848, Blatt 23 (detail; Austrian Academy of Sciences / The Woldan Collection, Vienna)



Fig. 3. The elevation of old Ostrobos with the remnants of the minaret (Peter Soustal, 1993)



Fig. 4. The remnants of the minaret (15th cent.) (Peter Soustal, 1993)



Fig. 5. The island (green) and the islet (red) of Lake Vegoritis (Google Earth, KML-layer by Mihailo St. Popović)

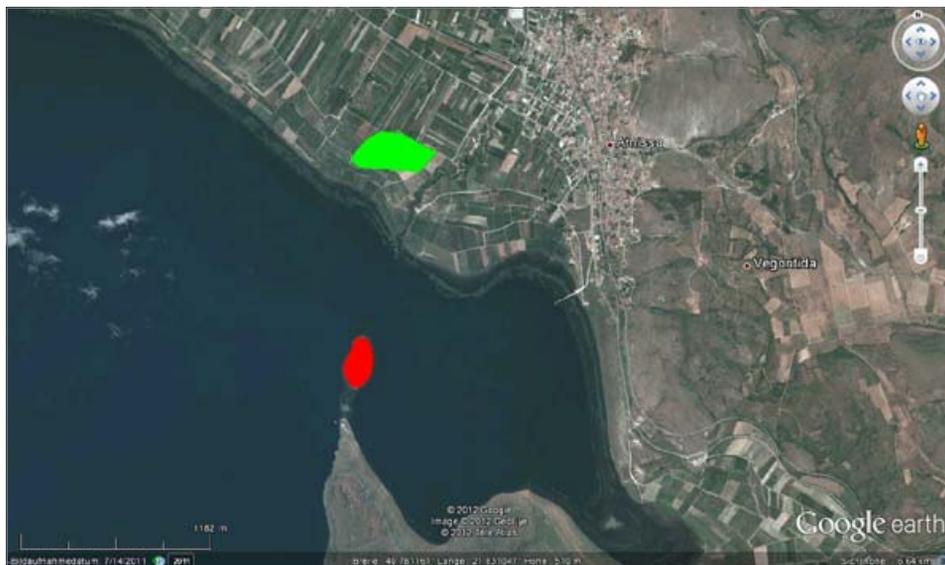


Fig. 6. The islet in Lake Vegoritis (Peter Soustal, 1993)



Fig. 7. The islet being a peninsula (Peter Soustal, 2005)



Fig. 8. The Via Egnatia on the northern shore of Lake Vegoritis in 1886 (detail; *Militär-Geographie. Macedonisches Becken mit dem albanesischen Küstengebiet. Mit 7 Tafeln und 6 Beilagen*, Wien 1886)

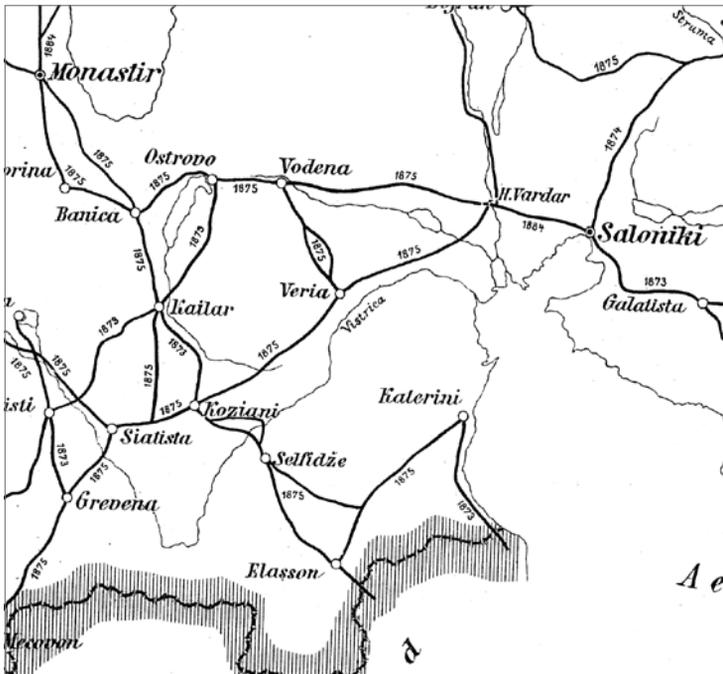
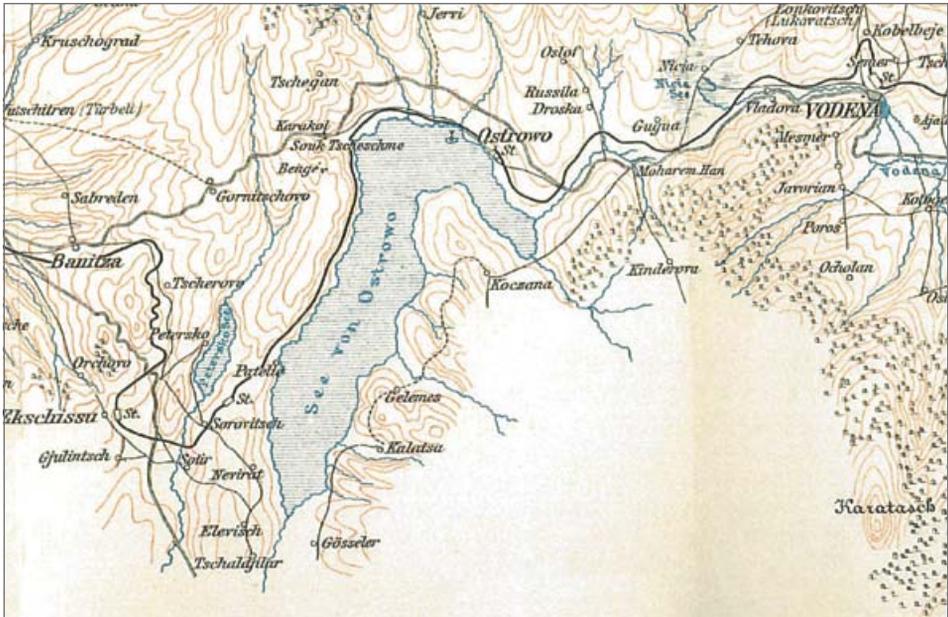


Fig. 9. The railway lines along the shore of Lake Vegoritits in 1934 (M. HASLUCK, *A Historical Sketch of the Fluctuations of Lake Ostrowo in West Macedonia*, GJ 87.4, 1936, p. 340–341, fig. 8)



Fig. 10. A map from 1894 with the island and the minaret marked onto it (1 : 300,000, detail; C. VON DER GOLTZ, *Ein Ausflug nach Macedonien. Ein Besuch der deutschen Eisenbahn von Saloniki nach Monastir*, Berlin 1894)



Figs. 13, 14, 15. The georeferenced map of VON DER GOLTZ (georeferenced with the software application QuoVadis 6.0.8 as well as KML-layer by Mihailo St. Popović; Google Earth)

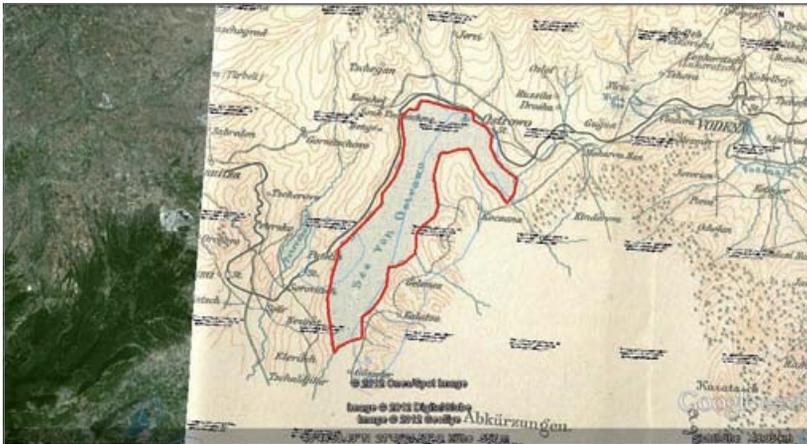


Fig. 16. The eight lakes in the southern Balkan peninsula (Mihailo St. Popović)

