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Late Pleistocene and Holocene Climatic Variability in the Carpathian-Balkan Region

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Reconstruction of the Late Holocene river channel shifts in the North-Eastern part of the Lower Danube Plain based on historical data

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Several periods of increased fluvial activity and accelerated runoff / deposition have been identified during the Holocene in different regions of Europe (Macklin et al, 2006). According to Starkel (2002) the older phases were characterized by an incision of deeper and wider tracks and, since Roman period, especially during the past millennium, tendency had changed to aggradation, braiding and river avulsions. The turn to a more stable fluvial regime caused further incisions and the development of narrow and smaller meanders. All these fluvial responses can be mainly correlated with the climatic fluctuations (cooler and wetter phases alternating with drier and warmer ones), socio-economic changes (increased anthropic pressure) or both. The last major period of concentration of extreme meteorological and hydrological events is the Little Ice Age (LIA), which conventionally took place between the 16th and mid 19th century (Lamb, 1984). However in Romania the study of LIA and the associate fluvial effects is rather poor. The data regarding hydro-climatological events (weather conditions, floods) in the medieval period (mostly collected by Topor, 1960) is scarce and based on the few local chronicles and diaries of the foreign travelers. However these confirm the increased frequency and magnitude of the rainfalls in the summer (with several important peaks in the 1590 – 1690 interval) as well as the hard winters well documented for the rest of the continent. Changes in the configuration of the stream network, due to avulsions, can be evaluated based on historical maps only with the first half of the 17th century and the dating of the fluvial records is still missing.

The North-Eastern part of the Lower Danube Plain (Fig. 1) is a large alluvial floodplain where Siret River collects several major tributary streams draining SE Carpathians (Putna, Râmnicu Sărat, Buzău) or the Moldavian Tableland (Bârlad), before joining Danube, near Galaţi. Surprisingly Siret's floodplain (until the confluence with Buzău) it is larger by a couple of kilometers than Danube's, despite the anastomosed character of the last one. This can indicate a progressive Holocene shift of the Siret's river course from the Carpathians to the eastern edge of the floodplain or a transformation from a multi-channel to a single channel pattern. The instability was also specific to main tributaries, as is confirmed by the presence of multiple abandoned sinuous courses and relict meander belts in the area. An important shift of the Siret River's lower course to a more eastern position during medieval times was briefly discussed, for the first time, by Antonovici (1929) based on couple of historical documents. The few questions we will try to answer to in this study are: When was formed the actual configuration of the river network in the study region? What was the impact of the LIA? How relevant can be the analysis of the historical data in the assessment of the river channel shifts?

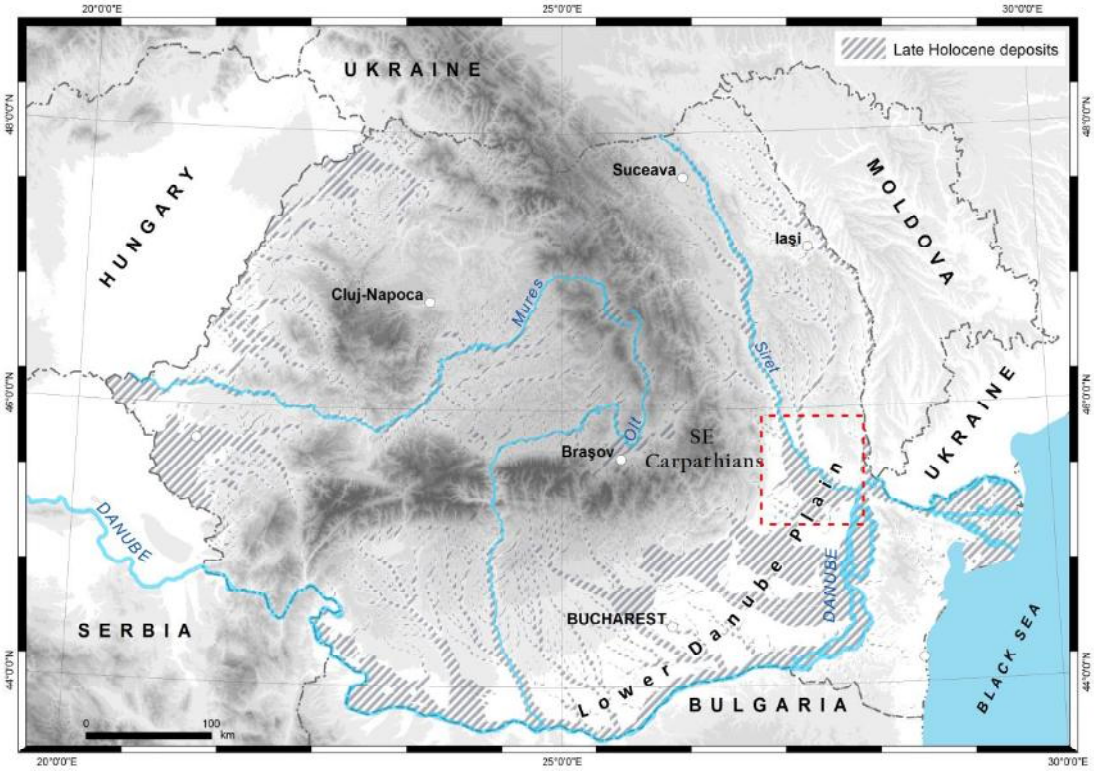

Fig. 1 The Lower Danube Plain - region of interest (red demarcation).

The research methodology involved gathering of the historical information related to river channel network in the study region, historical maps analysis and preliminary correlations with the relict fluvial landforms. To overcome the lack of detailed data about rivers geographical position within the floodplain, available only in some encyclopedic studies from the 17th and 18th centuries, we have included in the analysis the available collections of medieval charters (deeds) and travel literature. We considered about 250 documents mentioning settlements or lakes nearby Siret, Bârlad, Putna, Milcov, Râmna and Râmnicul Sărat river channels though for the position of the deserted medieval villages other sources were used. This information covers mostly the 15th - 18th centuries.

For the 15th and 16th centuries drainage network reconstruction confirms a more eastern meandering path for Siret while Bârlad probably had a longer course and reach Danube, near Galaţi (Fig. 2). Some of the streams draining Carpathian foreland had also shorter, different routes to Siret (e.g. Putna – north of Focşani) and other were direct tributaries (Milcov, Râmna – currently affluents of Putna). In the 17th century settlements and lakes previously reported to be along lower course of old Bârlad River started to be mentioned along Siret, which involve a north-eastern river shift. The older course, namely Old Siret or Little Siret - in the historical references, continued to collect more or less the Carpathian tributaries until the first half of the 18th century, when was completely clogged with sediment. Undoubtedly this issue forced Carpathians streams to extend their lower courses further east to the newer course of Siret. Minor changes, mainly anthropogenic, were recorded since then, thus, the current configuration of the hydrographic network seems to date, with few exceptions, from the first half of the nineteenth century. One can conclude also the impact of the hydro-climatic events during the LIA when the major

transformations occurred. Based on historical data mainriver channel shift took place shortly after the beginning of the 17th century (1600 – 1638/39).

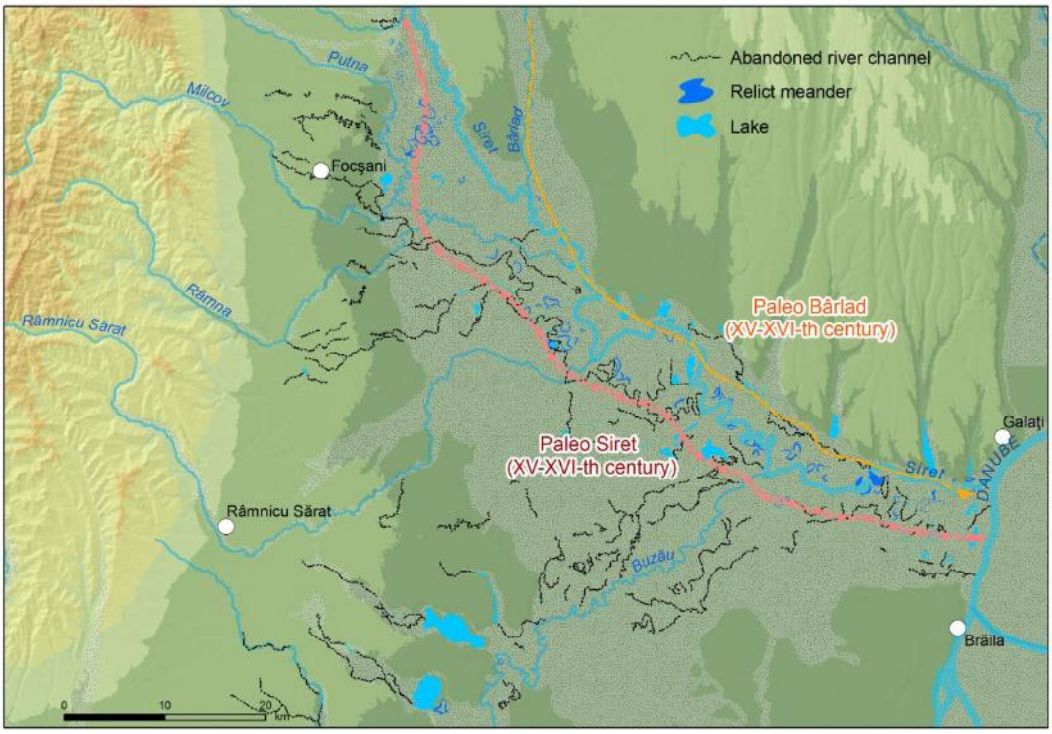

Fig. 2 Relict fluvial forms in the NE part of the Lower Danube Plain and the reconstructed river courses of Siret and Bârlad at the beggining of LIA, based on historical documents.

Our analysis indicated that the historical documents can contain partially reliable information for geographical reconstructions. These are not easy to read or interpret but are often very detailed. Starting with the 16th century medieval deeds are preserved in large number and information is continuously updated and exactly dated. Similarly historical maps can be used but there are some limits. The earliest cartographic materials for the Lower Danube region, made before the end of the 17th century, are not easy to interpret due to their reduced accuracy, exaggerations and distortions or lack of details. For the newer ones there is also little information related to their survey period: with few exceptions the maps made between the end of the 17th and early 19th century reflects partially that time geographical realities.

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