

A Geomorphological Study of the Vésztő-Bikeri Paleochannel, Hungary

Christine Boyd

Vészto-Bikiri (Vészto-20) is an early Copper Age single component archaeological site¹ that lies in the southwestern area of Hungary, roughly 15 kilometers from the Romanian border. The Tiszapolgar culture occupied the site for approximately 500 years, dating from about BP 5000-BP 4500. The Vészto-20 site is in a region called the Great Hungarian Plain, also known as the Nagy-Alföld². During the Holocene epoch³, geomorphological changes occurred throughout the plain, creating a predominantly flat landscape cut by rivers and channels. A dry shallow meander⁴ of the former Körös River lies adjacent to the Vészto-20 site. The purpose of this report is to present hypotheses that may relate the meander and the river that cut its channel to the development of the village site, Vészto-20.

The Hungarian Plain that occupies the southeastern area of the Carpathian Basin, is surrounded by the Carpathian and the Dinaric Mountains from the north to the east and down to the south. According to Chapman (1998; 149), the development of the Hungarian Plain is due to hydrological activity during the Holocene epoch. The plain filled with alluvial and aeolian deposits during the Pleistocene when water flooded most of the plain (Parkinson 1999; 96). There is no rock formation throughout the entire plain suggesting that there was reworking of the surface by rivers thereby preventing the lithification of sediments. The only lithic materials found at the Vészto-20 site are thought to be products of trade networks around the edges of the Carpathian Basin. Soil that is rich with calcium carbonate indicates the presence of a limestone source. In the surrounding mountains, there are high concentrations of limestone which indicates that water flow came from areas of higher sea-level that were limestone rich and when the

¹ The excavation of Vészto-20 is a current project that began in Summer 2000. The project is called the Körös Regional Archaeological Project. It is funded by the National Science Foundation until the year 2004. The archaeologists who are researching are Drs. William Parkinson, Richard Yerkes of The Ohio State University and Atilla Gyucha from the Munkácsy Mihály Museum in Békéscsaba Hungary.

² Hungarian term for the "Hungarian Plain". It extends throughout southeastern Hungary, eastern Croatia, northern Yugoslavia and Transylvania (western Romania). Its total size is approximately 40,000 square kilometers (Parkinson 1999; 96)

³ 10,000 years ago until present day.

⁴ The meander will be the focus of this project. It will be referred to as the "Vészto-20 meander" throughout this paper.

water flowed, it picked up calcium carbonate sediment in small quantities which eventually settled into the soil of channel areas.

Throughout human time, the Carpathian Basin has been inhabited by a multitude of cultures that migrated and settled in various areas. Some aerial photography has been completed in the Alföld, which indicates that there were many paleochannels in the plain and there is archaeological evidence that populations were settling in concentrations along the banks (Chapman 1998; 149). Human bones that date to half a million years were found at Vérteszolos in Transdanubia, suggesting that Neanderthal populations were present in the area to take advantage of hot springs and animals that roamed the area during the Paleolithic era (Fallon 1997; 11). More studies have been done on the Neolithic and their ancestors who have populated the Hungarian Plain since ca 7000BC (Parkinson 1999; 102). They came to the area as agriculturists to take advantage of the moist and fertile soil of the floodplains.

It is possible to study settlement patterns and geomorphological data to determine whether or not an extinct waterway was substantial enough to sustain viable organisms and whether or not it was a significant source of human resource procurement. By looking at the arrangement of archaeological sites along paleochannels and dating them, archaeologists can get an idea of how useful the waterway was and how long it was utilized. By studying the depth of a channel and clay and soil concentration, it is possible to determine how long it may have taken a river to fully develop and how forceful the water flow might have been. By measuring the size and location of the point bars in relation to meander curvature, levee formation and flood basin characteristics, it is possible to gain insight about how the channel developed.

Post-flood morphology is dependent upon many factors such as the path of the flooding, amount of water, the speed of the water flow, along with sediment and soil deposition. Meander patterns often maintain continuity for long distances and they follow patterns which are characteristic of natural water flows. Paleochannels are locations of former rivers that have dried. By studying the elevation patterns on

topographic maps, it is often possible to determine the hydrological patterns of channels and floodplains.

Many dry meanders lie within the flat landscape of the Carpathian Basin, suggesting that rivers and streams followed different paths than they do today. During the Holocene epoch, bi-annual flooding in response to climatic change resulting in the development of a wide floodplain across which meandering streams flowed. The Hungarian Plain was covered with swamps and oxbows that were created by the constant meandering rivers (Parkinson 1999; 98). Before flood control was imposed upon the river by cutting channels, the basin generally flooded twice a year. It flooded in the winter when snow and ice abruptly melted. The basin also had a tendency to flood in the spring after heavy rains raised the water level above riverbeds.

Four large rivers flow through the Carpathian Basin, of which the Danube is the largest. The Danube flows south from Bratislava to Budapest where it turns south to cross the basin to the Yugoslavian border (Parkinson 1997; 97, Pesci and Sarfalvi 1997; 27). The Tisza parallels the Danube to the east and is joined by major tributaries, the Körös and the Marös (Chapman 1998; 149). The Körös River, which flows across southeastern Hungary, was completely rerouted by man in the nineteenth century to reduce the adverse effects of flood damage. There are now 9000 km of artificial levees and 500 km of new river channels, which increase the amount of arable land and decrease the damage done by floods (Pesci and Sarfalvi 1977; 102).

The River that is called the Körös today is not the same as the one that was rerouted. The former river is called the Holt Körös Sebes⁵ and it parallels the more recent Körös River about 3250 meters to the west. The Vészto-20 meander appears on the topographic maps to come into contact with the path of the former river. There is evidence in the archaeological record that the Holt Körös Sebes was a dependable waterway for

⁵ In Hungarian; “the dead Körös river”

prehistoric societies. There are tell sites⁶ and Copper Age sites that occur along the abandoned channel of the rerouted river.

There is another Copper Age site adjacent to the Vészto-20 site, Körösladany-14. It does not get quite as much attention as the Vészto-20 because little significant information has been found there, thus far. It has been hypothesized that the Körösladany-14 site and the Vészto-20 site were actually one village or perhaps Vészto-20 was the village and Körösladany-14 was a relative area used for unknown purposes by the village inhabitants. The Veszto-20 site is on a levee that measures 86.2 meters above sea level. About 100 meters to the west of the center point of the Vészto-20 site, lies the center of the Körösladany-14 site, which is 86.2 meters above sea level as well. Both sites are on high ground that bisected by the Vészto-20 meander. When the Holt Körös River was rerouted in the 1930s, the workmen utilized as many natural meanders as possible to facilitate digging efforts. A man-made channel coincides with the Vészto-20 meander that separates the two sites. The bottom of the canal is approximately 83.2 meters above sea level and is congruent with the course of the natural meander over most of its length, according to the 48-24 map of Körösladany, Hungary. The meander floor has a consistent elevation of about 84m above sea level in areas where the man-made canal is not present. The width of the meander is between 40-50m in most locations. The canal that lies within measures exactly 7 meters across for its entire length⁷.

There is evidence that the Vészto-20 paleochannel is connected to the Holt Körös Sebes. The meander loop lies south of the Vészto-20 site with a curvature radius of 104.2m. After the meander loops to the southwest of Vészto-Bikiri, the paleochannel cuts across the levee on which the site exists and it heads northwest for approximately 3250m with an average curvature radius of 137.5m. The paleochannel then heads north for 1750 meters, then east, where it joins the Holt Körös Sebes northwest of the Veszto-

⁶ Most of the tell sites in the Hungarian Plain have cultural materials dating through the Neolithic period, with the occasional exceptions of some Copper Age materials found closest to the surface.

⁷ It should be taken into consideration that measurements were taken from the 28-244 map of Veszto, Hungary. Measurements taken from the map were calculated with the assumption that the landscape measurements were taken from edge to edge of sea level drop off, not water width.

20 site. The Holt Körös Sebes has an elevation of approximately 82m which is about two meters lower than that of the paleochannel, indicating that the Holt Körös Sebes is an older than the Vészto-20 paleochannel which probably joined later as a tributary.

The position of Vészto-Bikiri relative to the southern meander loop suggests that the villagers chose that area for defense purposes as it surrounded the site on three sides, in the shape of a semi-circle. Their positioning also allowed access to the channel for long-distance travel and trade. It is evident by the lithic and obsidian materials found at the site that the village inhabitants engaged in trade with other populations that lived on the outskirts of the plain along the Holt Körös Sebes.

The channel floor of the meander that isolates the Körösladany-14 site from the Vészto-20 site is about 2m lower than the surrounding floodplain. Depending on how long the channel has been dry, organic material has had time to build in the channel but not enough to significantly obscure the channel depth. It is likely that if a perennial river flowed through the area, it was shallow. In order for a shallow river to persist, it would need to have water fed to it from a consistent source. Otherwise it would turn still quickly and dry. Floodwater or glacial melt from the mountains could have provided constant water supply to the channel.

The dry channel that exists today may be a consequence of natural or man-made activities. It is possible that the channel dried naturally from the low rainfall causing the decrease of runoff from the mountains. Human intervention also could have caused the river to dry due to forest clearance and increased erosion between BP 4000 and BP 2000 (Starkel, 1994; 1). Tests could be made to see if the paleochannel was in existence until the Körös River was rerouted, when more uniform channels were developed or if it dried during the inhabitation of the Vészto-20 site, causing the villagers to seek habitation elsewhere.

Information from soil profiles may reveal evidence of paleochannels. Core samples taken near and in the channel reveal differences in soil materials, soil color, texture and

composition. In the vicinity of the Vészto-20 site, nine core samples were taken. Soil core samples were collected as far as 800 meters from the Vészto-20 site and the Körösladany-14 site, south and southwest from both sites. Samples were taken on both site highlands, in the channel and within other parts of meander to the west and to the south. No samples were taken to the east of the Vészto-20 site because of farming activity that was ongoing during the time of research.

Soil samples were taken from the channel and next to it to acquire materials so that testing may be done to prove whether or not the paleochannel existed between the two sites before the man-made channel was dug. It is also essential to test for the age of the channel to determine if the levee was a single land formation during the Copper Age inhabitation or if it had already split the formation into two before the levee was occupied. The natural meander is approximately 40 meters wide through the levee. It is plausible that the villagers built their homes and lived predominantly on the Vészto-20 side while using a footbridge or rafts to cross the channel and used that land for other purposes.

The first soil sample, called VE-20-1, was taken at the same elevation as the Vészto-20 site to the west approximately 5 meters from the western wall (E103) of the 10x10 meter trench at Vészto-20. This sample was taken at 86.2 meters above sea level. The second sample, called VE-20-2 at about 84.29 meters above sea level. The sample was taken the point where the landscape sloped into the meander about .9m above the water surface of the canal. This core was taken about 45 meters west of the 10x10 trench. The third soil sample, VE-20-3, was taken in the canal about 1 meter to the west of sample VE-20-2. The elevation level at the bottom of the canal is 83.2 meters, which is where the sample was initiated. The water rose about 1m above the ground surface. The fourth sample, KL-14-4, was taken on the adjoining site, Körösladany-14, in the middle of the site at the same elevation of the Vészto-20 site. This sample was cored about 80 meters west from sample VE-20-3.

The sampling pattern for the following five cores changed. They were taken at various points throughout the inside of the meander, up to 800 meters southwest of sample VE-20-1. They are numbered PC 1 through PC 5⁸. PC 5 was the only core that was taken at an elevation of 86 meters. It was taken to the north of the meander, about 800 meters from the original sample. The four cores from inside the channel were taken at various depths ranging from 85.5 meters to 84 meters.⁹ These five cores did not have any interfering plow zone in the top layers because all cores were taken from points of the meander that are overgrown with meadow. The only sample that showed the presence of calcium carbonate was PC-5, outside of the meander.

Samples taken at similar elevations had few consistent patterns suggesting that multiple floods and channel patterns disturbed soil and sediment deposition over a long period of time. With the exception of the VE-20-3 core, from the middle of the canal, the first 18 inches¹⁰ of soil were very dark brown, 10YR3/1, which is consistent with the plow zone. Soils changed color at alternate depths, ranging from dark brown to light gray. Granulation and sedimentation changed consistency without a standard pattern. Mottles of iron oxide and manganese appeared often in the samples but at different elevations. The soil ranged from silty clay to silty clay loam at the bottom. The canal samples contained more sandy material at lower depths. The soil was extremely mottled in some core sample intervals. There were areas of brown mixed with tan and gray. There were often bits of soil full of fine sand and below it would be a heavy clay mottle, probably due to animal or plant activity.

Calcium carbonate was present at the VE-20-1 sampling area from approximately 18-27 inches (68.58-45.72 cm) below the surface. K-14-4, at the same elevation and depth had traces of calcium carbonate as well at the same depths. Calcium carbonate was also found as deep as 72 inches (182.88 cm) in the K-14-4 sample. The soil below the canal

⁸ PC stands for paleochannel.

⁹ See accompanying soil chart for soil color and consistency results.

¹⁰ The sampling augers used were American so the samples were taken in 9 inch increments. To relate the depth metrically, the inches must be multiplied by 2.54 to get centimeter measurements.

had no calcium carbonate. The calcium deposits were found at higher elevations on either side of the meander. If water was flowing in the paleochannel, carrying limestone deposits, over-bank sediment built up by lateral accretion due to overflow, then it would be expected that calcium deposits would be present at that level. The depth at which calcium carbonate was found is consistent with level of the cultural layer at both sites, suggesting that the meander migrated from the area south of the levee and cut through it, possibly creating the oxbow south of the site around the time of initial occupation. It is also possible that the calcium carbonate was present below the ground surface under the canal at one time. The restructuring of the Holt Körös and canal digging may have displaced calcium-rich soil from the meander to the sides of the channel.

The Veszto-20 meander and the Holt Körös Sebes are crudely parallel on the topographic maps. They contain many similarities, not only in direction but in curvature radii as well. Curvature radii were taken of both the meander and the river from the 48-24 map. The meander has an average curvature radius of 123.8 meters. The Holt Körös Sebes has an average curvature radius of 122.14. It appears that the dead river had sharper curves than the Vészto-20 meander. It could be hypothesized that at one time, the paleochannel was as curvy as the Holt Körös Sebes and erosion caused it the curves to be less pronounced. It is also a possibility that the dead river existed for much longer than the paleochannel and therefore, it has had more time to create sediment buildup and alter the landscape more significantly. Another plausible hypothesis is that the Vészto-20 meander was part of the Holt Körös Sebes at one time as it was abandoned as a result of a cutoff during flooding. Rivers may change course by flooding over meander loops and flowing over the next lowest available course in the floodplain (Brown 1997: 29). As a point bar forms, the meander loop tends to migrate away from the deposit build-up.

In order to determine whether or not the two waterways existed concurrently, tests would have to be conducted on the organic materials found in the soils of the meander and the dead river to determine the age of various organic matter beneath the surface. A combination of relative and absolute dating techniques may be used to determine the evolution of the meander although neither ensures complete accuracy. The most absolute

method is C-14 although in alluvial environments the presence of reworked organic material that might produce a false date as may the problem of root contamination (Brown 1997; 51). If conducting C-14 tests in an alluvial area, it would be most efficient to test wood deposits because they produce the most reliable dates. It is likely, however, that after wood gets worked into the earth and mixed with other elements by erosion, it decays very quickly (Brown 1997; 51). Relative dating methods might pose a problem because organic materials in such an unstable landscape settle at different rates of time. Brown does suggest one method of dating land surfaces that was successful at a paleochannel site in the East Midlands of England. He suggests testing roots excavated from even matrix levels that are consistent with successively higher land surfaces. It is possible to date each individual land surface by dating the roots that penetrate down from it (Brown 1997; 51).

It is logical to assume that people settled in places where they had access to water. Water not only provides itself as a resource; it draws other natural resources as well as access to communication and transportation. Animal and plant remains appear consistently throughout the archaeological record, even where water systems do not exist today. The Rezkor Kupferzeit 2 map displays archaeological sites in the Békés area. The Vészto-20 site and the Körösladany-14 site both appear almost at the easternmost point of the meander, close to 1100 meters from the Holt Körös Sebes. Sites 10,15,16 and 119 all appear on the map around the bottom loop of the meander. Sites 89-92 and 97 follow the northwestern route of the meander. Site 80 is at the northernmost part of the Vészto-20 meander. Many sites follow along the southwest, then northeast of the meander, except in the flood pool area, where there is only one site. It is difficult to determine whether or not that site was there before or after the flood pool existed because the channel that caused the flood pool is unknown. Sites follow along the entire length of the Holt Körös Sebes. This site placement pattern indicates that habitation sites were indeed positioned for resource procurement by water. Many of the sites that follow the path of the Vészto-20 meander are from the Copper Age so it can be determined that the channel was probably present at the time of Copper Age inhabitation.

No shells have been found, thus far, at the Vészto-20 site. Shell caches have been excavated at the Vészto-Maygor tell site approximately 1.5 km from the Vészto-Bikiri site. Fish vertebrae have been found in small quantities at Vészto-20. These findings support the hypothesis that a nearby channel was present during the Copper Age.

A study done by Starkel (1994) explains how hydrological changes in the Vistula River Basin in Poland may give insight to floodplain history in the Carpathian Basin around the same time. Both areas were probably susceptible to the same environmental conditions during the Holocene, Subboreal and Atlantic periods that characterized climatic change in central Europe. According to Starkel, higher flood frequency occurred in the Vistula Basin from 4500- 4100 BP. During that time there were significant changes in vegetation cover in floodplain areas. That time period is consistent with the Vészto-20 and Körösladany-14 sites. According to Starkel, this time period marks the abandonment of valley floors by the Neolithic (1994; 6). Perhaps that is a period in time when some Copper Age populations migrated throughout the basin in search of higher land, such as levees, with immediate access to floodplain resources. Starkel comments that around 4100 BP, there is a relatively stable period of low flood occurrence that lasts until 3200 BP. During that time there is a slow transformation of flooded valleys to forests with diverse resources. That is close to the time when the Vészto-20 site was abandoned.

A community who is dependent on floodplain resources, during a period of resource depletion, would either migrate in search of a new floodplain or they would move to a more forested area to take advantage of the diverse resource distribution. Perhaps it was around this time that the Vészto-20 meander either depleted or changed drastically enough to alter resource procurement habits so that the community was forced to abandon the area and move elsewhere in the basin. The study of paleomeanders in the Vistula Basin in Poland is a model for further research that may be completed in the Vészto area of the Hungarian Plain.

Tentative conclusions may be drawn, thus far, from this research and analysis. The goal of this project was to analyze soil samples and maps to gain evidence that will be tested in the future as the Vészto-20 excavation progresses. In this paper, data has been organized and hypotheses have been developed to aid with that process. It has been hypothesized that the Vészto-20 paleochannel was a tributary of the Holt Körös Sebes during the Copper Age and divided the levee prior to inhabitation. The deposition levels of calcium carbonate in the levee as well as the cultural materials collected from the levee support this hypothesis. Absolute dating techniques will be employed to confirm whether or not the Copper Age materials coincide with sediment dates.

Another hypothesis that resulted from this analysis is that Vészto-Bikiri was abandoned ca BP 4500 due to climatic interference that altered the nature of the paleochannel. The reason for abandonment may be due to resource depletion or the collapse of defense security. The manner in which the villagers abandoned the site gives more supportive evidence for a defensive collapse. The Vészto-Bikiri inhabitants removed their valuables and then burned down the village, which suggests that their goal was to flee from possible danger and leave nothing for the attackers. If the paleochannel dried, the village was defenseless from all angles.

This type of project is essential to the archaeological process to aid in the understanding of Tiszapolgar culture and how they utilized water sources in their environment and effects of that environment on their lifestyles. These hypotheses will develop further as a result of expanded research at Vészto-Bikiri over the next several years.