3. *Kalicki T., Przepióra P., Podrzycki Ł.* Struktura i geneza terasy Kamionki obok Suchedniowa // Acta Geographica Lodziensia. 2017. T. 106. S. 53–64.
4. *Kondracki J.* Regiony fizycznogeograficzne Polski. Warszawa : Wyd. UW, 1977.
5. *Kondracki J.* Geografia regionalna Polski. Warszawa : PWN, 2002.
6. *Lewandowski J., Romanek A., Studencki M.* Formy akumulacji międzylobowej w rejonie Suchedniowa // Kwart. geol. 1975. N 4. S. 887–906.

UDC 551.4(438)

THE ŚWIŚLINA RIVER VALLEY STRUCTURE AT THE DOŁY BISKUPIE SITE (HOLY CROSS MOUNTAINS, CENTRAL POLAND) – PRELIMINARY RESULTS

T. Kalicki[1], P. Przepióra[1], E. Kłusakiewicz[1], Ł. Podrzycki[1], K. Fularczyk[1], G. Pabian[2], K. Żurek[3]
[1]Jan Kochanowski University in Kielce, Institute of Geography, Department of Geomorphology, Geoarchaeology and Environmental Management, ul. Świętokrzyska 15, 25–406 Kielce, Polska; tomaszkalicki@ymail.com, pawelprzepiora1988@gmail.com
[2]Jan Kochanowski University in Kielce, Institute of Geography, Department of Geotourism and Ecological Geology, ul. Świętokrzyska 15, 25–406 Kielce, Polska
[3]Student Science Club of Geomorphologists «Złoty Bażant», Jan Kochanowski University in Kielce, ul. Świętokrzyska 15, 25–406 Kielce, Polska

The structure of the Świślina river valley (Holy Cross Mountains, central Poland) was the subject of research dating back to the 1950s. Returning to this place after the years in 2014 and 2020 made it possible to use new methods in the analysis of sediments building studied area. For this purpose, climbing equipment was used to get to hard-to-reach places. Samples were taken for grain size and geochemical analysis. The results of analyzes based on magnetic separation of microscopic slags were also taken into account. These results allowed to obtain new data about the structure of this part of the valley. Changes in sedimentation associated with natural processes as well as with the intensification of human activity in last centuries (metallurgical activity, flash floods) were captured.

Key words: Świślina river valley; analysis of sediments; Poland.

The site is located in the Świślina river valley at Doły Biskupie, downstream from the «Wióry» water reservoir (Świętokrzyskie voivodeship). It is the north-eastern part of the Mesozoic margin of the Holy Cross Mountains, where the Triassic sandstones and shell limestones, marls and clay mudstones are covered with a thick layer of the Pleistocene loess. The relief is dominated by a low-relief plain (Palaeogene peneplain) that cuts down the age-different structural elements – the Palaeozoic, steep Godów fold, and the highly disturbed Triassic and Jurassic rocks. It is deeply cut by river valleys with terraced bottom, i.e. Świślina river. In its basin, loess areas developed a dense network of gullies and sunken lane (Fig. 1).

In the studied section, the valley has steep slopes, and two steps are marked at its bottom: a narrow 4.5–5.5 m high flood plain and a wider terrace raised 9–11 m above the river level (a.r.l) (Fig. 1). Both levels are build of fine-fraction sediments (anthropogenic muds), grain size similar to loess, in which numerous traces of metallurgical activity in the form of slags with a diameter of up to 25 cm were found. These traces indicate very young age and anthropogenic genesis of these sediments accumulation, related to the development of metallurgy [4].

In 2014 and 2020, a sediment study was undertaken on the site both within the left-bank of the flood plain and using specialist mountaineering equipment, in the five-meter exposure of loess on the right slope of the valley undercut by the river (Fig. 2). In addition to the standard grain size analysis by sieve and laser diffraction, the coarsest material was measured using the planimetric method. The geochemical analyzes of the flood plain alluvia were performed on the content of heavy metals such as Zn, Fe or Pb, as well as the magnetic separation of micro-slags from overbank sediments.

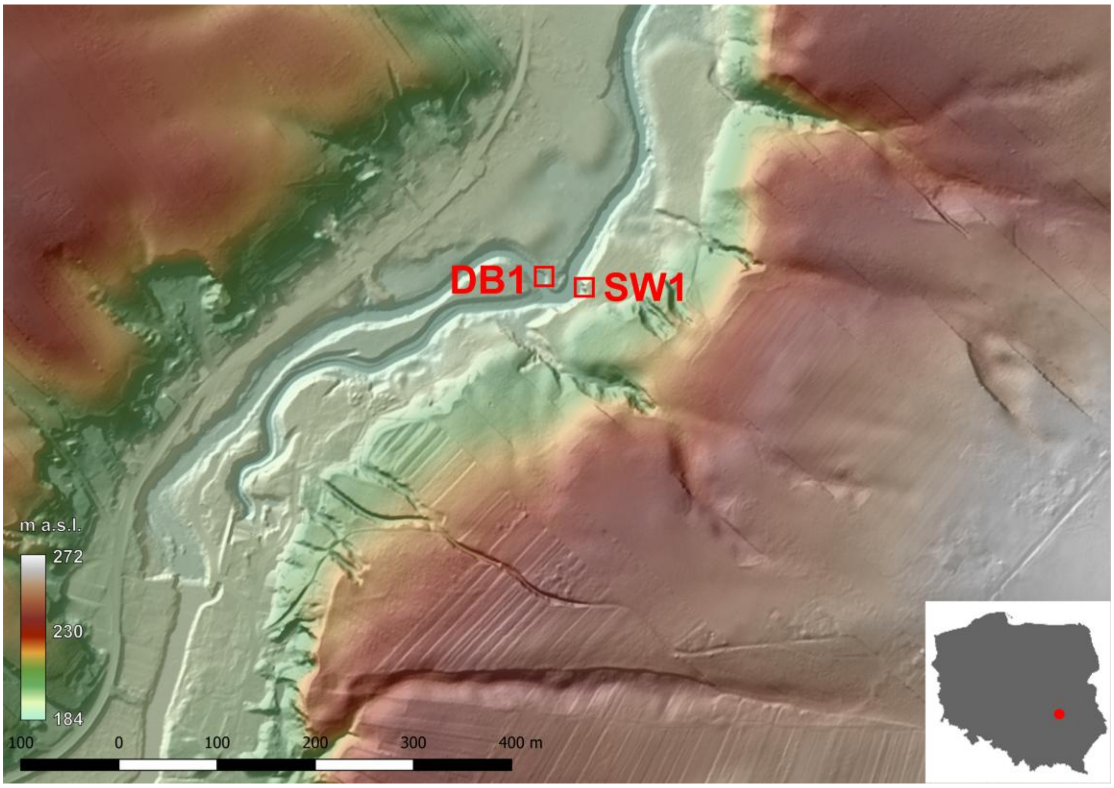

Figure 1 – The location of the study area (DB1 and SW1 profiles) in the DEM map (by K. Żurek, geoportal.gov.pl)

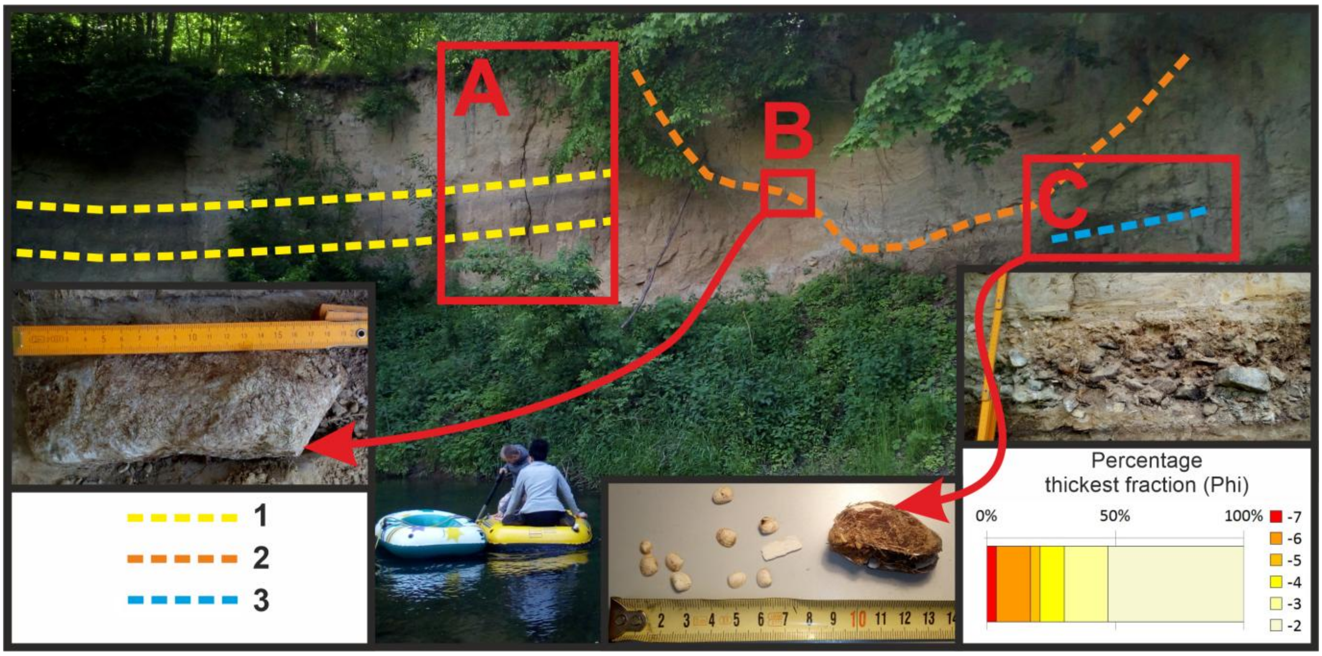

Figure 2 – The SW1 profile (photo P. Przepióra, 2020) in right-bank of the river
1 – buried soil (profile – A); 2 – buried gully filled with a loess and limestone boulder in the bottom (B); 3 – lens of sharp-edged shell limestone fragments and malacofauna (C).

The loess outcrop is several meters wide. To the left is a buried soil with a low organic content separating the two loess series (yellow line on Fig. 2). The older one, directly below the buried soil, is finer and decarbonated, which may be related to the development of soil formation processes. The upper series is more sandy, slightly carbonate, and the carbonate content varies significantly from 0 to 5 %. The graining and fluctuations in carbonate content may indicate that this is a sediment series redeposited from the plateau (Fig. 3). On the right side of the outcrop, a buried gully filled with a series of loess is visible. At the bottom of its filling, there is a sharp-edged 20 cm diameter limestone boulder. In the most extreme, right-site part of the outcrop, at a height of approx. 2 m a.r.l. the lens of sharp-edged shell limestone fragments with a maximum diameter of 10 cm is preserved. This layer is about 25 cm thick, and in its highest part, there are undamaged shells of *Unio* and other species of malacofauna (Fig. 2C). This layer may be related to the catastrophic flood that occurred after the dam of the «Wióry» water reservoir was a failure in 2001 [1]. The traces of catastrophic flows (flash flood) are coarse sediments. During the descending flood wave, malacofauna was deposited in the upper part of these sediments. Similar coarse cut and fill alluvial body related to catastrophic flash floods after dam failures are also known from other Holy Cross Mountains river valleys [2, 3].

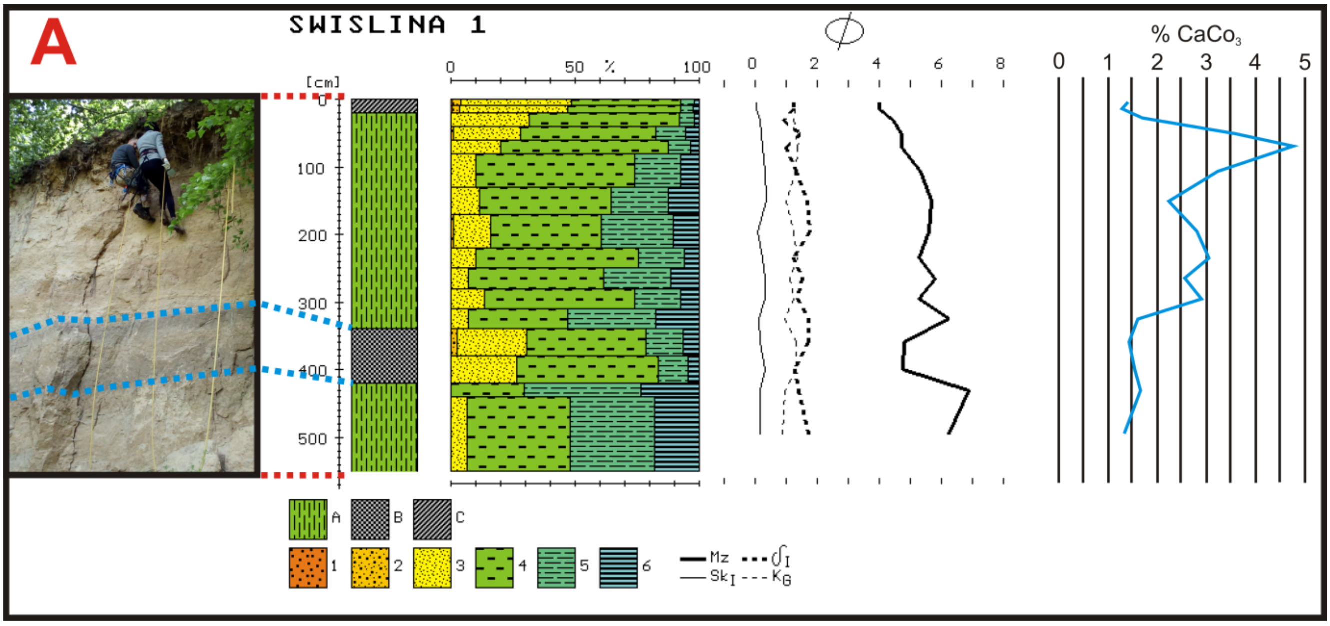

Figure 3 – The SW1 profile (P. Przepióra 2020) with the $CaCO_3$ concentration
Lithology: A – loess, B – buried soil, C – A-horizon of present-day soil; Fractions: 1 – gravel (below -1φ); 2 – coarse sand (-1–1φ), 3 – medium sand (1–2φ), 4 – fine sand (2–4φ), 5 – coarse and medium silt (4–6φ), 6 – fine silt (6–8φ), 7 – clay (above 8φ); Folk-Ward's grain size distribution parameters: Mz – mean size, δ_I – standard deviation, Sk_I – skewness, K_G – kurtosis

The Świślina River basin is located in an area where the Prehistoric metallurgy developed (bloomers), and later, in the Middle Ages and modern times, in the Old Polish Industrial District area. Metallurgy activity was concentrated along many rivers in the Holy Cross Mountains region, including Świślina river, which is confirmed by historical data.

In the DB1 profile of the floodplain, on the lag deposits (poorly rounded gravels) there are overbank sediments, silts with an admixture of sands. With the aid using the magnetic gripper, ferromagnetic particles were separated from the overbank sediments, among which numerous microscopic iron balls (spherules) appear (Fig. 4). They occur only in the upper and middle part of the profile, above the distinct sandy flood layer confirming that the sediments above were accumulated during the modern metallurgy activity period. There are many markers of the metallurgical activity in the catchment area what was confirmed by the presence of larger slag fragments described in the 1950s in the profiles made on this site [4].

The geochemical analysis of the sediments in this profile showed an increase in the content of elements towards the surface, with the maximum concentration at 25–105 cm depth (Fig. 5). This tendency, in particular in the case of iron and manganese, clearly correlates with the presence of microslags, the markers of the historical industry influence in this area. Increased geochemical accumulation can also be connected with a large share of the fine-grained fraction, influencing the sorption properties of the sediments, and with the reaction determining the migration of individual elements in the profile. Moreover, an inverse relationship was found between the content of the studied metals and the concentration of carbonates. The geochemical changes and microslags are an excellent marker of metallurgical activity and are helpful in the interpretation of the processes, genesis and age of alluvia at the studied site.

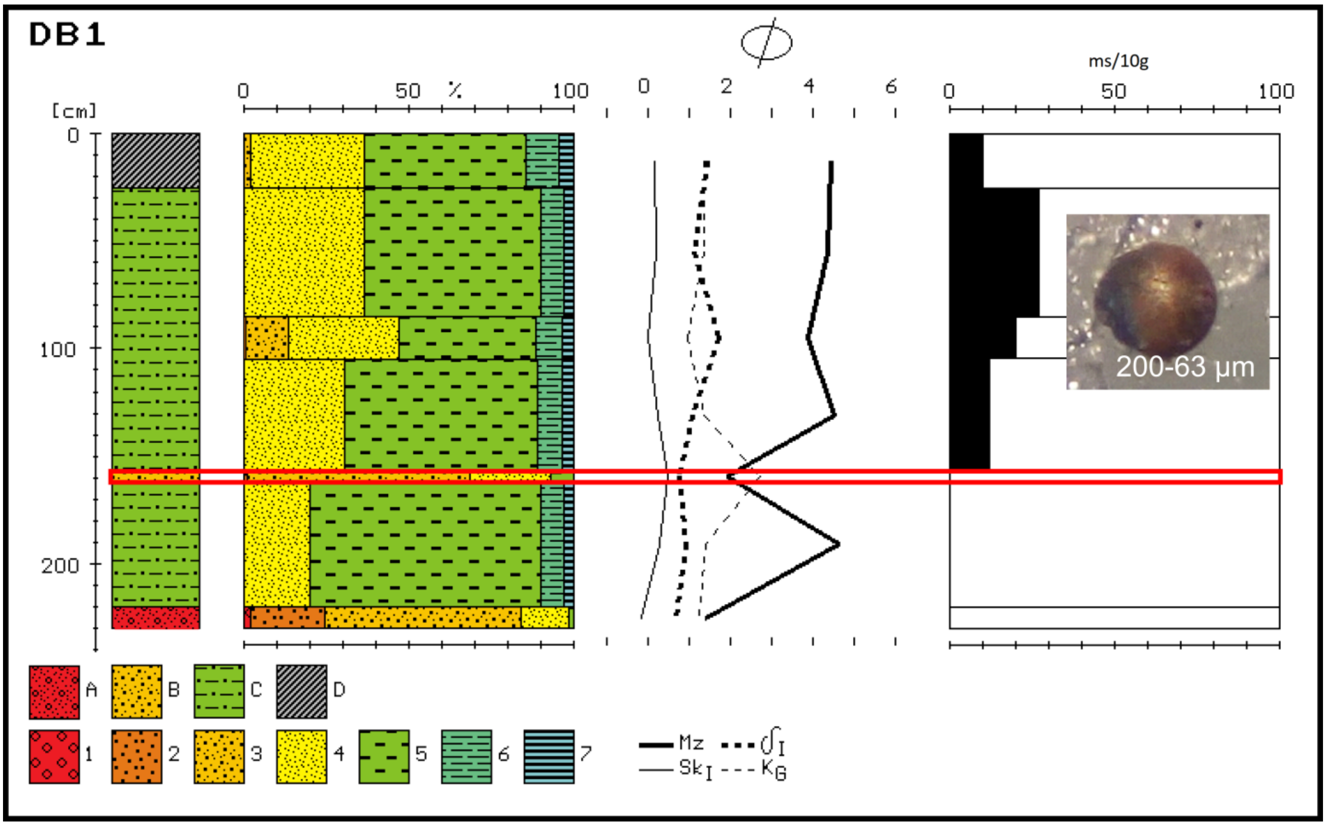

Figure 4 – The DB1 profile with the microslags (iron balls) concentration (ms/10g – microslag per 10 grams of material). The red box marks the flood layer location

Lithology: A – sands with single gravel, B – medium sands, C – sandy silts, D – soil;

Fractions: 1 – gravel (below -1φ); 2 – coarse sand (-1–1φ), 3 – medium sand (1–2φ), 4 – fine sand (2–4φ), 5 – coarse and medium silt (4–6φ), 6 – fine silt (6–8φ), 7 – clay (above 8φ);

Folk-Ward's grain size distribution parameters: Mz – mean size, δ_I – standard deviation, Sk_I – skewness, K_G – kurtosis.

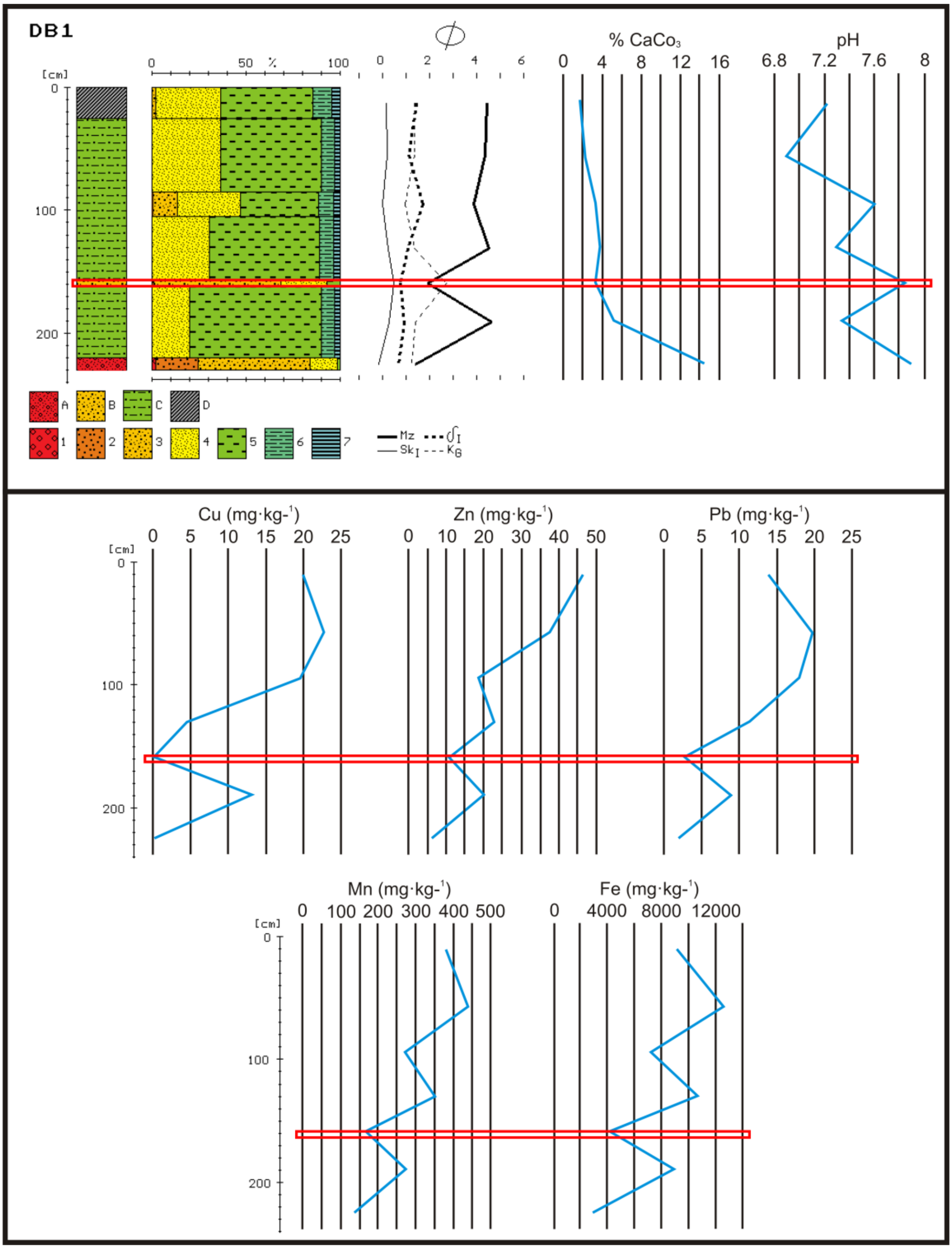

Figure 5 – The DB1 profile with the $CaCO_3$ concentration, pH parameter and geochemical concentration of heavy metals. The red box marks the flood layer location

Lithology: A – sands with single gravels, B – medium sands, C – sandy silts, D – present-day soil;
Fractions: 1 – gravel (below -1φ); 2 – coarse sand (-1–1φ), 3 – medium sand (1–2φ), 4 – fine sand (2–4φ), 5 – coarse and medium silt (4–6φ), 6 – fine silt (above 6–8φ), 7 – clay (above 8φ);
Folk-Ward's grain size distribution parameters: Mz – mean size, δ_I – standard deviation, Sk_I – skewness, K_G – kurtosis.

References

1. *Ciupa T*. Przyrodnicze i antropogeniczne uwarunkowania oraz skutki powodzi w zlewni rzeki Świśliny w lipcu 2001 roku (Góry Świętokrzyskie) / P. Szwarczewski, E. Smolska (eds.). *Zapis działalności człowieka w środowisku przyrodniczym*. Warszawa : Wyd. UW, 2012. S. 29–34.

2. *Kalicki T., Przepióra P., Kusztal P.* Antropogeniczne powodzie błyskawiczne na dwóch wybranych rzekach Świętokrzyskich w XX w. – Przyczyny i skutki // Prace i Studia Geograficzne. 2019. T. 64, Z. 1. S. 21–36.
3. *Kalicki T., Przepióra P., Kusztal P.* Origin and effects of anthropogenic flash floods on rivers of Holy Cross Mts. region (Poland) in 20th c. // Acta Geobalcanica. 2019. Vol. 5, N 1. P. 85–92.
4. *Klatka T.* Muły antropogeniczne doliny Świśliny i ich dynamiczna interpretacja // Łódzkie Tow. Naukowe. Wydz. III. 1958. N 54. S. 165–187.

UDC 551.58(438)

PALAEOENVIRONMENTAL CONTEXT OF THE SUBNEOLITHIC HUNTER-GATHERER COMMUNITIES OF THE NIEMEN CULTURE – CASE STUDY AT LIPSK SITE (NE POLAND)

M. Frączek[1], A. Bęben[2], A. Wawrusiewicz[3], T. Kalicki[1]
[1]Jan Kochanowski University in Kielce, Institute of Geography, Department of Geomorphology, Geoarchaeology and Environmental Management, ul. Świętokrzyska 15, 25–406 Kielce, Polska; marcinfraczek1987@gmail.com, tomaszkalicki@ymail.com
[2]Student Science Club of Geomorphologists «Złoty Bażant», Jan Kochanowski University in Kielce, ul. Świętokrzyska 15, 25–406 Kielce, Polska
[3]Department of Archaeology, Podlaskie Museum in Białystok, Rynek Kościuszki 10, 15-426 Białystok, Poland; archeologia@muzeum.bialystok.pl

The study area is located in the NE part of the Biebrza Basin (ice-marginal valley on the borderland between Central and Eastern Europe in NE part of Poland) in Podlasie voivodeship. The region was an oecumene of hunting and gathering communities during the Neolithic period. Their lifestyle was inextricably linked to the vast valley area and connected to the climate fluctuations. These communities were in constant motion and did not develop an established lifestyle. Results of the studies on Lipsk, and other sites in the Biebrza Basin, indicate some periods of climatic changes and an increase of morphogenetic processes activity. Presence of peats dated at 7 050 ± 60 (MKL-4798) 6 033–5 789 cal. yr BC on sandy sediments in profile L22 could be correlated with the older colluvial deposits at Lipowo site. In profile L20 on the Preboreal peats enters the Boreal or Early Atlantic sandy sediments, which were covered by the Atlantic peats. The aeolian activity could have led to the appearance of sands at the bottom of the L20 profile between 9 880 ± 100 BP (9 803–9 182 cal. yr BC) and 7 350 ± 110 BP (6 425–6 026 cal. yr BC).

***Key words*:** Podlasie region; Niemen Culture; subneolithic hunter-gatherer communities.

The main aim of this work is to present the results of geoarchaeological studies of the Lipsk area and the reconstruction of selected components of the environment from the time spare of the Niemen culture. The study includes the archaeological site (*on-site* study) and surroundings (*off-site* study). Relief of this region was formed during Middle Polish (Saalian) Glaciation – Warta Cold Stage. During the next ice-sheet advance until the Pomeranian phase (Fig. 2) of last glaciations, about 16.2 ka BP [4] or 15.5–15.0 ka BP [6], outflow from Naroch-Wilia and Skidel dam lakes and river waters of the upper Neman river followed Łosośna river valley, it's tributary Tatarka river breakthrough Pripilin-Nurki gap section to Biebrza and Narew river valleys [3, 6, 9] (Fig. 1). Therefore the Biebrza is underfit river with vast peat-bogs on its valley floor. However, in the close vicinity of the archaeological site, we can find traces of a now non-existent watercourse, which could be connected with LGM (Fig. 1, 3) only in a short distance from Haciłówka to Biebrza (Fig. 1).

Nowadays the archaeological site is a well-exposed dune-like elevation with an area of about 1 ha, in the central part of a large peat-bog. From the south, it adjoins the modern Biebrza riverbed.