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

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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 Łososna 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.

On the eastern side of the elevation, at a distance of about 100 meters, there is an oxbow lake with is the remnant of a now non-existent watercourse, whose relic is the extensive (about 0.5 ha) old lake partial covered by the floating mat (Fig. 2). In the depression, there are peats and peaty silts with a thickness of up to 6 meters in borehole L21 (Fig. 3). Based on *off-site* studies it was possible to create schematic geological cross-section for the surrounding area and more detailed for the archaeological site and part of the dune.

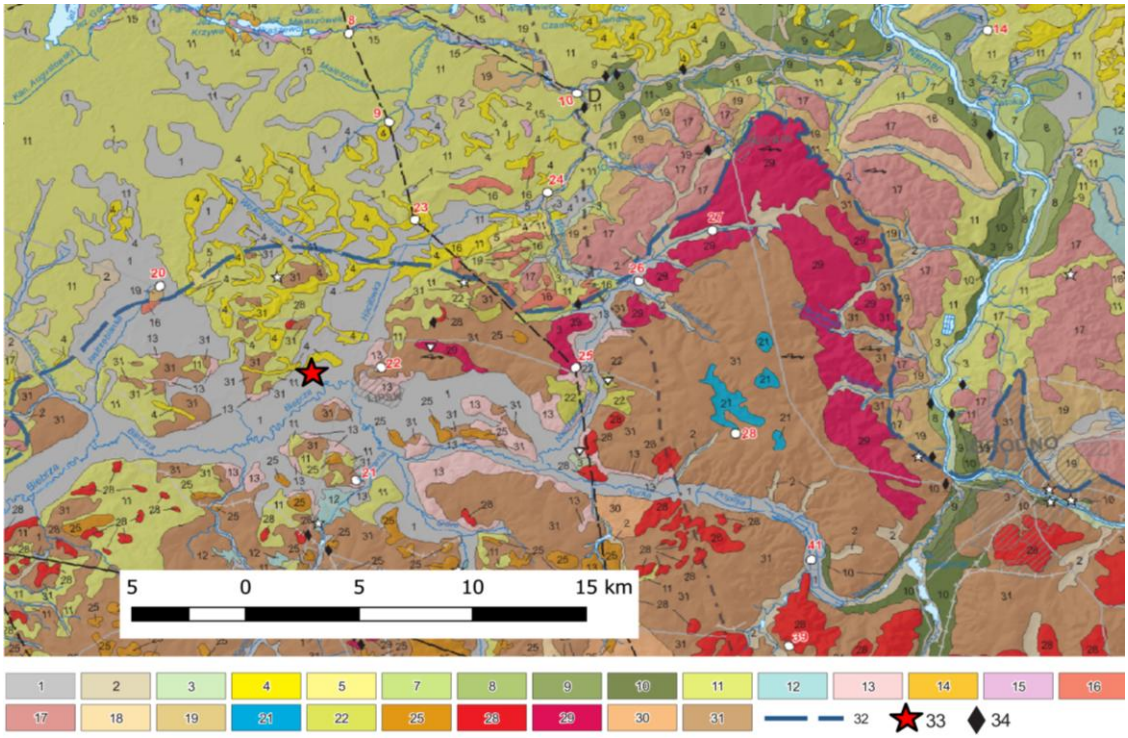

Figure 1 – Part of geological map 1 : 250 000 [5]

Within the site and its surroundings can be distinguished several different age geological segments. The first one is an elevation built of dune fine and medium-grained sands. The second one, located at the foot of the elevation, is a part of the sandy alluvial plain of a braided river. A beginning of peat accumulation in the valley floor (L20 borehole) was radiocarbon dated at 9 880 ± 100 BP (MKL-4799) 9 803–9 182 cal. yr BC (Fig. 3). In the next stage occurred beginning of peat accumulation, near an archaeological site at Lipsk, which was radiocarbon dated at 7 600 ± 90 BP (MKL-4801) 6 633–6 254 cal. yr BC in the bottom of L22 profile (Fig. 3). Around the same time, 7 350 ± 110 (MKL-4798) 6 425–6 026 cal. yr BC, peats enter on deluvial (colluvial)/aeolian/fluvial deposits? (samples under analysis) in L20 profile (Fig. 3). After that, 7 050 ± 60 (MKL-4798) 6 033–5 789 cal. yr BC, on the same kind of sediments? (not cleared yet) enters peats in profile L22 (Fig. 3). After that event, at both profiles, starts the accumulation of undisturbed peats. The archaeological trench was located on the south-eastern edge of the dune at a distance of about 10 m from the currently visible slope of the dune (Fig. 2, yellow box). This area was chosen because of the possibility of capturing well-preserved stratigraphic systems that can be

correlated with specific settlement phases in the palaeoenvironmental context. During the archaeological research in the 2019 season, nearly 2 000 artifacts were documented. Most of the Prehistoric material discovered at this site was flint material. Fragments of ceramic vessels represent only 10 percent of this collection. The artefacts were in all explored layers. The first, few finds were recorded at a depth of about 0.2 m, in the bottom of the peat. Up to a depth of about 0.5 m, these elements were clearly culturally incoherent. In the same stratigraphic system, flint products characteristic for the Preboreal period (Kunda culture) and the Atlantic period (Janisławice-Neman culture) coexisted. They were also accompanied by fragments of ceramic vessels from different periods. The youngest of them should be dated at the beginning of the Subatlantic period (about 2 500–2 000 BP).

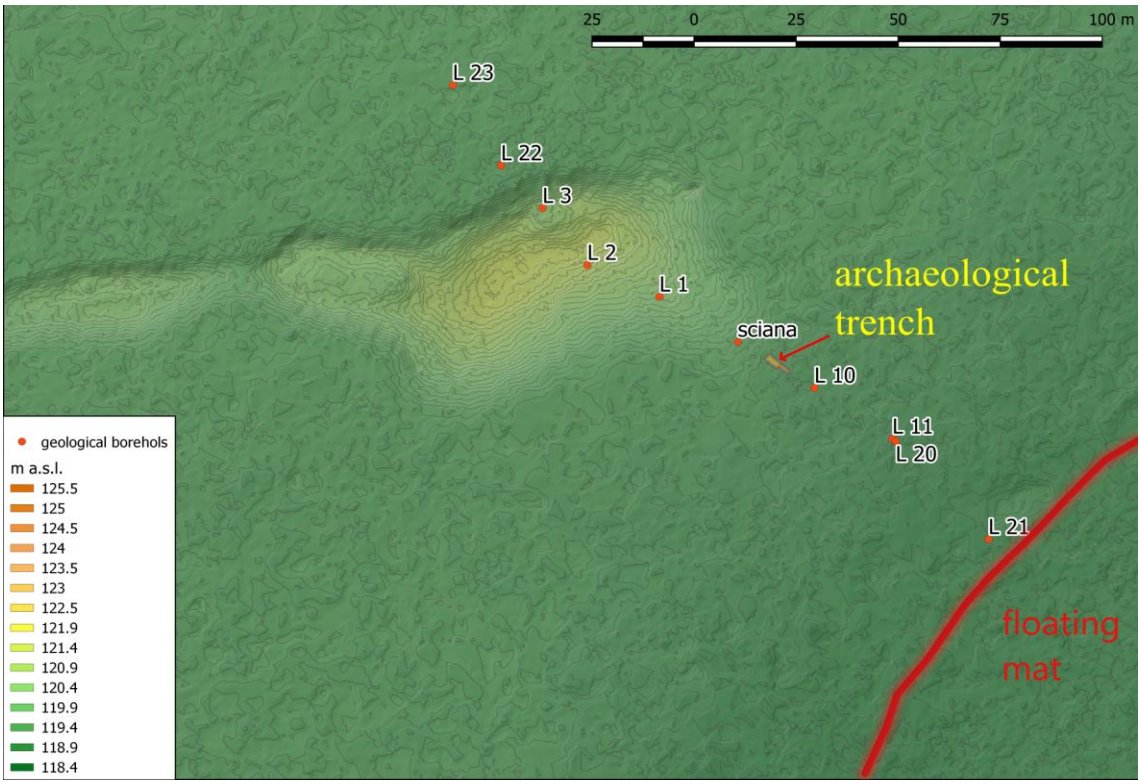

Figure 2 – Location of the geological boreholes and archaeological trench

Correlating these archaeological data with the stratigraphic layers of the excavation profile, it can be assumed that these materials could be mixed by the colluvial processes. This process was probably launched in the Subatlantic period. It caused the dislocation and mixing of archaeological material associated probably with the existence marks of encampments or settlements located in higher parts of the dune. Below this stratigraphic segment, homogeneous archaeological material, related to the settlement and economic activity of the Subneolithic hunter-gatherer communities, was documented (Neman culture). Most of the artefacts discovered here have been preserved *in-situ*, including a deposit of several fragments of flint blocks and cores. At this level, fragments of ceramic vessels have also been registered, which can be initially dated for a period of about 7-6 thousand years BP. The presence of several products of the Late Palaeolithic origin is unclear. These artefacts were found in the lowest strata of anthropogenically transformed position. They may not be as obvious proof of the old settlement. There are many examples when the old flint artefacts/products were transferred and used in much later times.

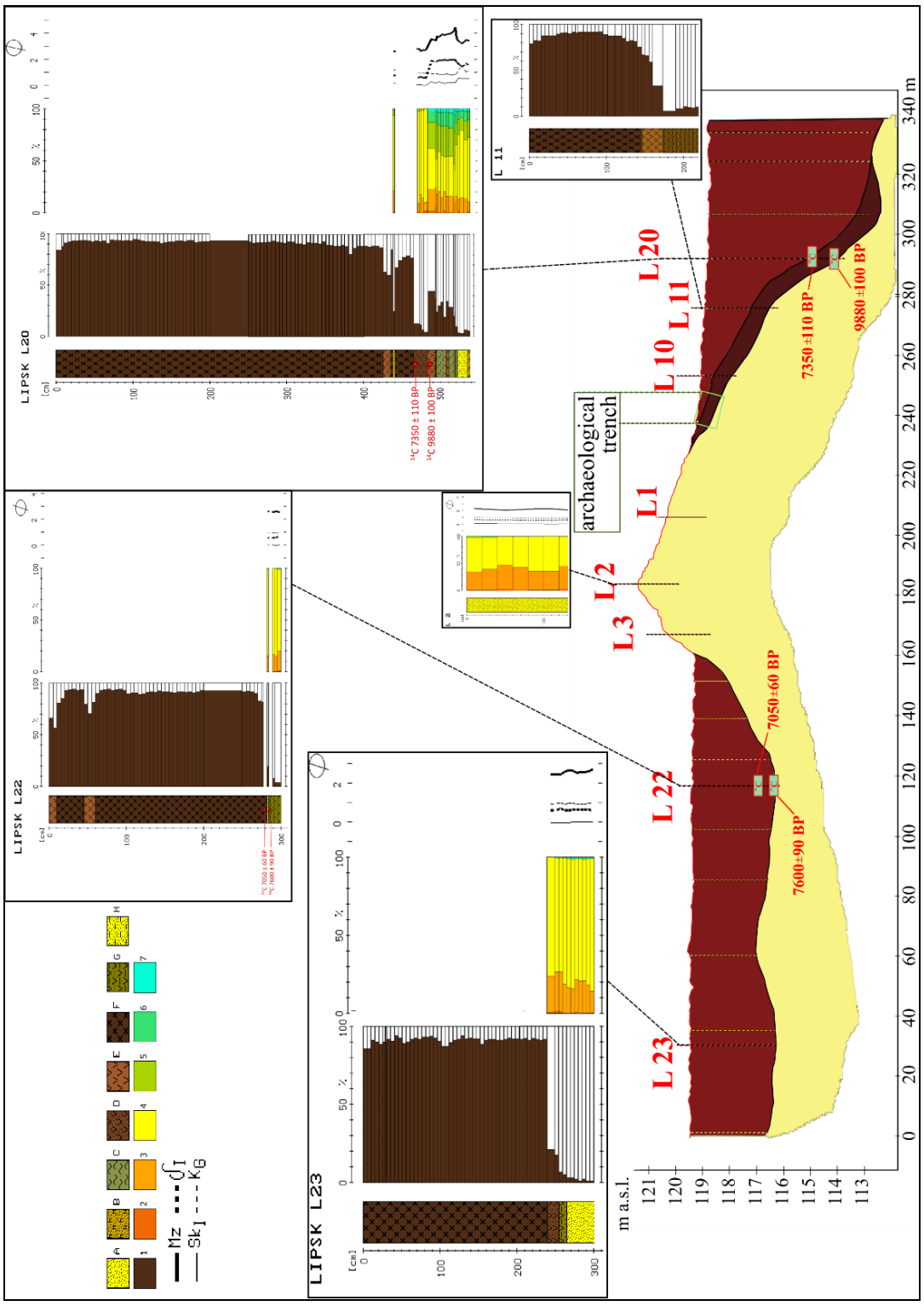

Figure 3 – Geological cross-section of Lipsk site, lithology, grain size and Folk-Ward's distribution parameters of selected profiles

Lithology: A – fine sands, B – peaty silts, C – silty peats, D – peats;

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

Folk-Ward's distribution parameters: Mz – mean diameter, δ_I – standard deviation (sorting), Sk_I – skewness, K_G – kurtosis.

Results of studies at Lipsk and other sites in the Biebrza Basin [1, 2, 7] indicates 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 deposited after 7 020 ± 70 BP (6 016–5 746 cal. yr BC), which have been covered with peat-bog during the next humid period at the end of the Atlantic [2]. The origin of this sediment is still unexplained (during laboratory analysis). In profile L20 we are dealing with different age sequence. On the Preboreal peats enters the Boreal or Early Atlantic sandy sediments, which were covered by the Atlantic peats. Aeolian activity during this period is not excluded. Around the same time, that kind of activity took place near Grzędy site [7]. Within the non-fluvial segment of Wizna Basin, the dune complex is surrounded by peats whose thickness reaches 2 m and the bottom was ^{14}C dated at 10 135 ± 90 BP (10 143–9 396 cal. yr BC). The surface under the peats was transformed by aeolian processes at the end of the last glaciation and the Younger Dryas cooling resulted, in probably, that the complex of parabolic dunes was still active at the end of the Late Glacial and Early Holocene.

After the climate warming in the Preboreal starts the accumulation of peats but with short-time an increase of aeolian processes activity at the beginning of the Atlantic – 8 320 ± 80 BP (7 542–7 141 cal. yr BC) [7, 8]. These phenomena 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). After detailed sedimentological analyses, we will be able to answer the question of what kind of sediment and in what kind of sedimentological environment it was deposited (Fig. 3 – L20 and L22 profiles). Around the same time in the Wizna Basin had occurred macromeander at Ruś site cut off 14C dated at 9 900 ± 90 BP (9 762–9 231 cal. yr BC) [1] and the beginning of peat accumulation on calcareous gyttja at Włochówka site ^{14}C dated at 10 290 ± 120 BP (10 593–9 664 cal. yr BC) [1]. The elevated form located near Lipsk certainly belongs to one of the most interesting archaeological sites in the Biebrza Basin. Its size and variety of documented settlement phases forces discussion mainly about the role it played in the context of environmental conditions determining the lifestyle of hunting and gathering communities. The technological and morphological characteristics correspond to the general «idea» of the Late-Mesolithic lithic technology of hunter-gatherer communities from the areas of north-eastern Poland from the beginning and the first half of the Atlantic period (comp. [1, 2]).

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СРАВНИТЕЛЬНАЯ ХАРАКТЕРИСТИКА НЕФТЕГАЗОНОСНОСТИ ПОГРАНИЧНЫХ РЕГИОНОВ ДРЕВНИХ ПЛАТФОРМ

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Нефтегазоносность Предуральского и Енисей-Хатангского прогибов связана с Волго-Уральским нефтегазоносным бассейном и Енисейско-Анабарским газонефтеносным бассейном. В статье на материале этих двух близких по тектонической терминологии структур (обе являются краевыми предорогенными прогибами) выявлены не только черты их сходства, но и существенные различия, приведшие к особенностям как их углеводородных систем, так и к обнаруженным и прогнозируемым в древних и молодых нефтегазоносных комплексах особенностям ловушек неструктурного типа.

Ключевые слова: нефтегазоносный бассейн; неструктурные ловушки; краевые прогибы; органическое вещество; древние платформы; нефтегазоносные комплексы.

В статье рассматриваются особенности углеводородных (УВ) систем краевых (передовых, предорогенных) Предуральского и Енисей-Хатангского прогибов древних платформ – Восточно-Европейской и Восточно-Сибирской. Нефтегазоносность этих прогибов связана с Волго-Уральским нефтегазоносным бассейном (НГБ) и Енисейско-Анабарским газонефтеносным бассейном (ГНБ). Задачей исследования является детальный анализ возраста продуктивных комплексов древних платформ, типа и количества содержащегося в них органического вещества (ОВ), степени его катагенной преобразованности, фазового состояния добываемых флюидов, свойств нефтей и газов этих прогибов. Материал статьи является обобщением, дающим общую картину условий и среды нефтегазоносности, и базируется как на справочном материале [1–4], так и на личных разработках авторов [5–8].

Оценка перспектив нефтегазоносности невозможна без изучения формирования и структуры ловушек. В НГБ с длительной историей освоения ресурсов УВ низка вероятность открытия крупных месторождений нефти и газа, приуроченных к антиклинальным структурам. Эта тенденция проявляется при поисках месторождений УВ сырья на территории не только российских, но и многих зарубежных НГБ, в которых добыча нефти и газа ведётся многие десятилетия и где создана необходимая инфраструктура и сконцентрированы трудовые ресурсы. В связи с этим, необходимость изучения проблемы ловушек не вызывает сомнений. О значении типа ловушек и их перспективности с точки зрения ресурсов свидетельствуют многолетние исследования, проведённые группой специалистов [9]. Авторы показывают значимость в мировых запасах УВ сырья открытия месторождений с ловушками различного происхождения: комбинированных, стратиграфических, структурных. Особый статус придаётся ловушкам клиноформных структур, ловушкам в выступах фундамента и сланцевых формациях (так называемые протяжённые или тонкие). Именно с этими типами ловушек в настоящее время связаны открытия месторождений с крупными и гигантскими запасами УВ.