Editorial

Fifty years have now passed since the publication in 1969 of Jan Kowalczyk's text entitled *Początki neolitu na ziemiach polskich* [*The Origins of the Neolithic Age on Polish Territories*] (*Wiadomości Archeologiczne*, 34(1): 3-69), which was an exceptional work because of its critical stance towards existing knowledge. The theses and opinions contained in this publication quickly aroused wide discussion in the milieu of Polish archaeologists, and they also became an inspiration for later research.

This anniversary has prompted us to prepare a thematic publication, which contains texts by over a dozen researchers making use of the latest research to discuss the nature of the economic, technological and cultural changes that took place in the 6th to 3rd millennia BC in the Polish lands and in their immediate vicinity. The centre of attention of most of these articles is the state of knowledge about the origins and beginnings of the production economy in Polish lands, including the formation of native Neolithic social structures.

The volume also contains articles that examine the thought and research of Jan Kowalczyk from today's perspective. This scholar, an outstanding expert on Neolithic issues, occupies a well-established place in Polish archaeology, while his discoveries and hypotheses are cited in Polish and foreign literature to this day. The importance of his academic achievements was discussed by the participants of a one-day scientific conference *The beginnings of the Neolithic in the Polish lands. On the hundredth anniversary of the birth of Jan Kowalczyk*. This took place in Lublin on November 22nd, 2018 on the initiative of the Institute of Archaeology of the Maria Curie-Skłodowska University in cooperation with the Institute of Archaeology and Ethnology of the Polish Academy of Sciences and the State Archaeological Museum in Warsaw. The authors of the papers presented and discussed there also prepared more extensive texts for this volume.

This number of *Archaeologia Polona* also includes works related to the issues of the Neolithic in micro-regional and symbolic dimensions (such as the paper that deals with the symbolism of some decorative motifs on ceramic vessels from that time).

Halina Taras, Hanna Kowalewska-Marszałek and Sławomir Sałaciński

Fig. 1. Conference room: in the front row from the left: Pavel Burgert (Praha), Dagmara H. Werra (Warsaw), Stanisław Kukawka (Toruń), Małgorzata Rybicka (Rzeszów), Sławomir Kadrow (Rzeszów), Stefan K. Kozłowski (Warsaw), Wojciech Borkowski (Warsaw); in the second row, from the right: Elżbieta M. Kłosińska (Lublin), Józef Niedźwiedź (Zamość). Photo: T. Wiśniewski.

Fig. 2. The conference participants: Dagmara H. Werra (Warsaw), Stanisław Kukawka (Toruń), Małgorzata Rybicka (Rzeszów). Photo: T. Wiśniewski.

Fig. 3. Wojciech Borkowski and Sławomir Sałaciński (Warsaw) presenting Jan Kowalczyk's activities in the State Archaeological Museum in Warsaw. Photo: T. Wiśniewski.

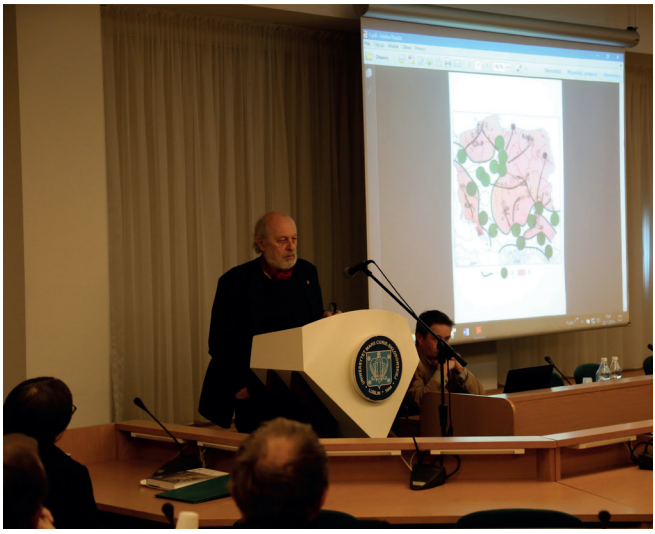

Fig. 4. Stefan K. Kozłowski (Warsaw) giving his lecture. Photo: T. Wiśniewski.

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Jan Kowalczyk (23.10.1918 – 25.01.2007). Photo: Archive of the IAE PAN.

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Docent Dr hab. Jan Kowalczyk (1918–2007)

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Jan Kowalczyk was born on October 23, 1918 in Nowa Wieś in the Lubartów district, Lublin voivodeship. After graduation from the Jan Zamoyski State Gymnasium in Lublin in 1937 and after six months of practice at the Gdańsk Shipyard, he began studies at the Faculty of Ship Machinery Construction at the Gdańsk University of Technology. After the Second World War interrupted his further education, he stood as a volunteer to fight with the German invaders in defence of Lublin in the tragic events of September 1939 (Białasiewicz and Gzella 1994: 130–131, 208, 212). During the German Occupation, he worked physically at the painting workshop in Lublin. After the War, in 1945–1948 he studied at the Faculty of Humanities at the Catholic University of Lublin (KUL). He was a student of Jan Czekanowski (1882–1965), former rector of the Jan Kazimierz University in Lviv and head of the Department of Anthropology of the KUL, of Stefan Nosek (1909–1966), head of the Department of Prehistory of the Maria Curie-Skłodowska University (UMCS), classes at the KUL, and of Józef Gajek (1907–1986), at the same time head of the Departments of Ethnography and Ethnology at the KUL and UMCS.

During his studies, J. Kowalczyk worked in succession as a librarian in the Hieronim Łopaciński Public Library in Lublin – in the period from 10.1944 to 30.06.1945 (Bieleń 2005: 15, 24) and at the Department of Anthropology of the KUL (for part of the academic year 1945/46). From June 1st 1946, he was an employee of the Department of Prehistory (now the Institute of Archaeology) of the UMCS, initially (in the years

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1946–1949) as a junior, and then as a senior assistant. From the beginning of his employment, he actively participated in organizing the scientific and didactic base. Professor S. Nosek recollected later, that by the creation of the Department was *a lot of merit and disinterested work of the first archaeologist educated in Lublin and the first assistant of the Prehistory Department of the UMCS, MA Jan Kowalczyk*. Already in the first months of his work, he was delegated to the Western Territories (the parts of pre-war Germany that became part of Poland after World War II) to secure books for the university library and for the Department of Prehistory. Thanks to him, the Library of the Institute of Archaeology is equipped with a rich collection of interwar German literature on archaeology. In 1948, he obtained a master's degree in the field of anthropology, ethnography with ethnology and prehistory at the KUL, based on the work *Lubelszczyzna w okresie wpływów rzymskich* [*Lublin region in the period of Roman influences*]. In 1951, he defended his doctoral thesis at the UMCS *Obrządek pogrzebowy w młodszej epoce kamienia na ziemiach polskich* [*The funerary rite in the Late Stone Age in the Polish territories*], written under the guidance of Professor S. Nosek. The work could not be published, because – according to reviewers' opinions – it did not include references to the dialectical method of historical materialism. In the same year, J. Kowalczyk was dismissed from work due to the liquidation of recruitment for archaeological studies at the UMCS. He returned to the university in 1953.

As an assistant to the Department, J. Kowalczyk had the additional function of the delegate of the State Archaeological Museum (PMA) – as conservator of archaeological monuments of the Lublin and Bialystok voivodships) – and for this reason, among others, he monitored the state of the hillforts and visited the places of accidental discoveries. In 1949 he participated in the first archaeological expedition (by horse-drawn cart!) across the Hrubieszów district.

In the years 1951–1952, he was the organizer and the first post-war head of the Department of Archaeology of the Lublin Museum. He organized the first permanent archaeological exhibitions in Lublin and Zamość. In 1952–1953 he participated in the work of the "Research Commission on the Cherven Cities (or Grods)", taking part in excavations in Gródek on the Bug, in the Hrubieszów district (on a settlement neighbouring the early medieval stronghold of "Wołyń") and in Lipsko Kolonia in the Zamość district.

After Professor S. Nosek left Lublin, J. Kowalczyk was in 1953–1954 the head of the Department of Archaeology of Poland at the UMCS. Released from the university "for ideological reasons", from January 1st, 1955, he moved to the PMA in Warsaw, where he took the leadership of the Neolithic Department, and in 1971 he became deputy director for scientific affairs.

In 1954–1957, on behalf of PMA, he conducted research – iniciated in 1953 by Konrad Jażdżewski – on a large Neolithic settlement in Gródek, Hrubieszów district, on the Horodysko hill. He published detailed reports on this work (Kowalczyk 1956;

1957a; 1957c; 1959a [1958]) in the national archaeological journal *Wiadomości Archeologiczne*. All the material obtained at that time was later submitted to study by Witold Gumiński, a PhD student at the Institute of the History of Material Culture of the Polish Academy of Sciences (Gumiński 1989).

After habilitation in 1969 at the University of Warsaw, based on the work (Kowalczyk 1969b) entitled *Początki neolitu na ziemiach polskich* [*The Origins of the Neolithic Age on Polish Territories*], in 1972 he moved to the Institute of the History of Material Culture of the Polish Academy of Sciences (IHKM PAN; since 1992 the Institute of Archaeology and Ethnology), where he worked as the head of the Stone Age Department until he retired in 1978. He returned then to the UMCS Department of Archaeology, where he worked in the post of a docent until 1989.

Docent Jan Kowalczyk was one of the best experts on the Neolithic in Poland. He specialized mainly in the issues of Funnel Beaker culture (FBC) and archaeological research conducted especially on the sites of this culture (Stok, Las Stocki, Klementowice in Puławy district, Gródek in Hrubieszów district, Krzemionki Opatowskie in Ostrowiec Świętokrzyski district).

The source material from his research, his findings and hypotheses quickly entered into scientific circulation. A significant part of them is cited in Polish and foreign literature, including in the monumental synthesis *Prahistoria ziem polskich* [*The Prehistory of Polish Lands*], vol. I, II, III (edited by W. Hensel in 1975; 1978; 1979) and in volume I of the academic textbook *Pradzieje ziem polskich* [*Prehistory of Polish Lands*] (edited by J. Kmieciński in 1989). In a wider circle of readers from 1970s he is known as the author of a popular book (Kowalczyk 1971b) published by the Polish Archaeological and Numismatic Society, entitled *Zmierzch epoki kamienia* [*The Twilight of the Stone Age*], which received very good reviews in Polish and Ukrainian journals. He was also quoted in the Ukrainian and Russian language versions of the *Archaeology of the Ukrainian SSR* (1971; 1975) and in the volume *The Eneolithic* of the monumental series *Archieologija SSSR* (Vol. 4: 1992).

Jan Kowalczyk was a deeply religious man. He published his thoughts in the journal *Rycerz Niepokalanej* [*Knight of the Immaculate*]. He was characterised by extraordinary modesty and delicacy, winning him the favour of all who were lucky to commune with him.

He was a teacher of many classes of students of archaeology and history at the UMCS – where he lectured in 1948–1951, 1953–1955, 1960–1963 and 1975–1989. He was awarded by the University with medals "Nauka w Służbie Ludu" ["Science in the Service of the People"] in 1974, and "Zasłużony dla Uniwersytetu Marii Curie-Skłodowskiej" ["Meritorious for the Maria Curie-Skłodowska University"] – only the eighth such medal issues until that date (2004); he had also been awarded earlier, in 1970, he was honoured with the medal "Zasłużony dla Archeologii Polskiej" ["Meritorious for Polish Archaeology"].

He received other decorations as well – for professional and social activity in the Polish Archaeological Society he was awarded the Golden Cross of Merit, the Medal of Meritorious Cultural Activist, the Medal of the 20th anniversary of IHKM PAN, the prize of the Scientific Secretary of the Polish Academy of Sciences (Balcer 1998; Zakościelna 1999; Libera and Gurba 2003: 8–10; Rozwałka 2003).

He died in Lublin on January 25, 2007. As Professor Andrzej Abramowicz recalled him: *he was a man of righteousness, with a discreet sense of humor, a good friend, and an ardent Christian* (Abramowicz 2010: 17).

JAN KOWALCZYK AT THE STATE ARCHAEOLOGICAL MUSEUM IN WARSAW

Jan Kowalczyk's first contacts with the State Archaeological Museum in Warsaw (PMA) fall in the year 1949, when he took a two-week internship at the Warsaw museum (Zakościelna and Gurba 2007: 384).

In 1954, after being released from the UMCS for ideological reasons, he became involved with the PMA for a longer period (Fig. 1). Museum director, Professor Zdzisław Rajewski, who had a very strong position and support in the government spheres of the Polish People's Republic, was not afraid to hire Jan Kowalczyk. He entrusted him with the function of head of the Neolithic Department, and at the end of his Warsaw museum career (in 1971) – the post of deputy director for scientific affairs (Zakościelna and Gurba, 2007: 385).

Publications of Jan Kowalczyk from the Warsaw museum period

The numerous scientific works by Jan Kowalczyk are well-known in the milieu of researchers on the Neolithic. His achievements can be described as universal. We find both source and synthetic publications in his output. Here we may note just a selection, presented in a chronological order.

One of the first of the publications in this period was a report on graves of the Globular Amphora culture (GAC) from Las Stocki and Stok, Puławy district (Kowalczyk 1953).

In 1956 and 1957 articles devoted to the study of important Neolithic sites were published – settlements and cemeteries of the FBC in Klementowice, Puławy district (Kowalczyk 1957b) and of the FBC settlement in Gródek, Hrubieszów district (Kowalczyk 1956; 1957a; 1957c). Continuation of work in Gródek (Fig. 2), mainly in the area of the so-called "maidan" [square], was discussed in a subsequent article (Kowalczyk 1959a).

In 1956–1957, Jan Kowalczyk discovered inhumation graves with ceramics decorated with cord impressions in the area of this settlement. He described these finds in an article in *Wiadomości Archeologiczne*, connecting them with the Mierzanowice culture, which was at that time known as the Tomaszów culture (Kowalczyk 1959b).

Fig. 1. Jan Kowalczyk in his study in the State Archaeological Museum in Warsaw. Photo: T. Biniewski.

Fig. 2. Jan Kowalczyk during the excavation in Gródek on the Bug [Nadbużny], Hrubieszów district, in 1954. Photo: T. Biniewski.

In 1961, a paper by Jan Kowalczyk from the symposium in Prague from 1959, concerning the relationship between the FBC and the Tripolye culture (Kowalczyk 1961) was published.

In 1962, Jan Kowalczyk presented his remarks concerning the state of research on the Neolithic of Polish lands (Kowalczyk 1962d); he postulated the necessity for periodic scientific reviews to verify the state of knowledge. In the same year, a very interesting work was published devoted to Neolithic collective graves (Kowalczyk 1962e) and another paper on the importance of test excavations in archaeological research (Kowalczyk 1962c) as well as some kind of summary of the results of the study of the FBC settlement in Gródek, intended for a wider audience (Kowalczyk 1962b).

Jan Kowalczyk did not avoid theoretical discussions, which found expression in the article (Kowalczyk 1963b) *Terminologiczne konsekwencje* [*Terminological consequences*]. The author refers to the work of Witold Hensel, devoted to these issues (Hensel 1958). He responds, among other things, to the question of distinguishing prehistory (as a science exploring the oldest history of man), from archaeology (treated here as an auxiliary science of prehistory and history). In the same year, he published an important work (Kowalczyk 1963a) regarding the problems of the Neolithic in Poland in the light of the research results of that time.

Jan Kowalczyk, as an employee of the PMA, did not avoid the problems of archaeological exhibition. He expressed his views in 1964, in the context of the preparation of the exhibition *Uwagi o organizowaniu wystaw* [*The Beginnings of the Polish State*], discussing issues related to the organisation of the exhibition (Kowalczyk 1964c).

Three significant articles appeared in 1968. The first of them was about Neolithic complexes from the FBC settlement in Gródek and burial complexes of the GAC from Klementowice that had radiocarbon dates (Kowalczyk 1968a), the second one was on issues related to the Corded Ware culture (Kowalczyk 1968c) and the third discussed cultural transformations in the Neolithic (Kowalczyk 1968b).

One of the fundamental works of Jan Kowalczyk is the publication (Kowalczyk 1969b) *Początki neolitu na ziemiach polskich* [*The Origins of the Neolithic Age on Polish Territories*], which caused a huge scientific discussion (Kempisty and Gurba 1971; Kozłowski 1971). The author answered his reviewers in a very consistent manner, responding to their comments according to a coherent scheme while discussing the various aspects of the aforementioned work (Kowalczyk 1972).

An equally important publication, *The Funnel Beaker culture*, which is a synthetic approach to issues related to FBC, appeared as a chapter of the published in English synthesis *The Neolithic in Poland* (Kowalczyk 1970).

A short but important work by Jan Kowalczyk, devoted to the main problems of the Polish Neolithic, was published in 1971 in *Sprawozdania Archeologiczne* (Kowalczyk 1971a). It contained remarks regarding methodological and cultural issues, analyses of the sources and significance of Polish Neolithic in Central Europe.

The popularization of archaeology in the case of Jan Kowalczyk was not limited to activities in the archaeological reserve area in Krzemionki Opatowskie, Ostrowiec Świętokrzyski district (Fig. 3), and to participation in the organization of exhibitions at the PMA. He wrote, among other things, an article (Kowalczyk 1962a) *Nim koło zaczęło służyć człowiekowi* [*Before the wheel began to serve man*]. In the pages of the popular archaeological magazine *Z otchłani wieków*, among others, appeared his articles: (Kowalczyk 1964a; 1964b) the two-part *Lud amfor kulistych* [*People of the Globular Amphoras*], and (Kowalczyk 1969a) *Neolit przedceramiczny na ziemiach polskich?* [*A pre-ceramic Neolithic on Polish lands?*]. He was also the author of the popular book (Kowalczyk 1971b) *Zmierzch epoki kamienia* [*The Twilight of the Stone Age*]. Combining science with its popular dissemination is, in spite of appearances, a very difficult task. Jan Kowalczyk mastered this skill to a significant degree, bringing it to a high level.

The publications of Jan Kowalczyk from his Warsaw museum period were published in the most prominent periodicals of Polish archaeology in the centres of Warsaw, Łódź and Cracow, such as *Wiadomości Archeologiczne*, *Materiały Starożytne*, *Sprawozdania PMA*, *Archaeologia Polona*, *Sprawozdania Archeologiczne*, *Prace i Materiały Muzeum Archeologicznego i Etnograficznego w Łodzi*. The conciseness of these studies, ranging from several to several dozen pages, deserves to be underlined. Despite their compactness, they are written in a very transparent way, and accounts, reports and syntheses do not contain prolix contents and descriptions – they just get to the heart of the matter.

Excavation research

From the field activity of Jan Kowalczyk in the discussed period, the above-mentioned investigations (1954–1957) of the site 1C in Gródek should be noted, with the remains mainly from the FBC (Fig. 4). These are some of the most important ones, along with excavations of Zofia Podkowińska in the settlement area at the site "Gawroniec" in Ćmielów, Ostrowiec Świętokrzyski district, also related to the FBC. In spite of numerous open-area excavation works from recent years connected with large investments, they are still of paramount importance for research on the Neolithic in Poland and in Europe.

No less important was the research of mine No. 5 in the area of the banded flint mining complex in Krzemionki Opatowskie, Ostrowiec Świętokrzyski district (1969–1970), associated with the FBC or GAC – unfortunately its exploration was not completed. After the first season, Zygmunt Krzak withdrew from the research team, having doubts as to the methodology of field work, which, however, from the perspective of the time and experience of the *Team for Prehistoric Flint Mining Research* of the PMA in Warsaw, should be assessed more positively. Bogdan Balcer, however, was full of research energy. The continuation of this work was difficult for formal reasons: upon the request of Professor Witold Hensel the passage of Jan Kowalczyk to the IHKM

Fig. 3. Jan Kowalczyk's discourse during his excavation in Krzemionki Opatowskie (in 1969 or 1970). Photo: Archive of the State Archaeological Museum, Warsaw.

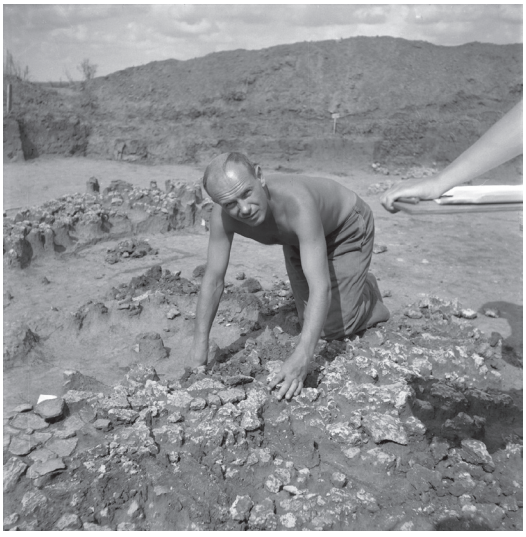

Fig. 4. Jan Kowalczyk during the excavation in Gródek on the Bug [Nadbużny], Hrubieszów district. Photo: T. Biniewski.

PAN was prepared, while Krzemionki Opatowskie remained in the administration of the PMA. An important result of the said research was the summary (Balcer 1996) of their results by Bogdan Balcer, *Cel i wyniki badań w Krzemionkach w latach 1969-1970* [*Objectives and Results of Studies in Krzemionki in 1969-1970*] that was published in the third volume of the PMA publication series: *Studia nad Gospodarką Surowcami Krzemiennymi w Pradziejach* [*Studies on the Economy of Flint Raw Materials in Prehistory*]. Bogdan Balcer was one of the eminent specialists in the field of Neolithic flint working, and this synthesis underlining the role of Jan Kowalczyk as the field director of the research of mine No. 5, is a proper expression of respect and responsibility for the work that had been started but for many reasons not finished.

JAN KOWALCZYK AT THE INSTITUTE OF THE HISTORY OF MATERIAL CULTURE OF THE POLISH ACADEMY OF SCIENCES

The "Warsaw" story of Jan Kowalczyk is also the time of his work at the Institute of the History of Material Culture of the Polish Academy of Sciences (IHKM PAN; since 1992 the Institute of Archaeology and Ethnology of the Polish Academy of Sciences) where he moved in 1972. This was – especially in comparison with others – a relatively short period, covering only slightly over six years (October 1, 1972 – November 31, 1978), ended with his early retirement and return to Lublin.

Based on the resolution of the Scientific Council and the decision of the Scientific Secretary of the Polish Academy of Sciences, Professor Jan Kaczmarek, Jan Kowalczyk was employed at IHKM PAN as an independent scientific worker, carrying out research tasks related to the problem: *Research on ethnogenesis, development and culture of ancient societies, especially the Slavic ones*, topic 1.3.3: *Formation of new economic and social relations in the Neolithic and the Bronze Age.* Throughout his work at the Institute, he was also the Head of the Stone Age Department, gathering a large group of researchers dealing with the diverse issues of Palaeolithic, Mesolithic and Neolithic periods. Among them were: Romuald Schild, Maria Chmielewska, Maria Marczak, Halina Królik, Jadwiga Mościbrodzka, Elżbieta Sachse-Kozłowska, Hanna Więckowska, Jan Trzeciakowski, Bogdan Balcer, Danuta Rauhut, Ludmiła Graba-Łęcka-Paderewska, Leszek Gajewski, Jacek Lech and Zygmunt Krzak.

In addition to coordinating the research work of the team, Jan Kowalczyk also took an active part in the scientific life of the Institute, participating in national and international conferences and symposia. In 1975, after the death of Professor Zofia Podkowińska, and in accordance with her testamentary bequest and will, he supervised the transfer of her archaeological book collection to the Department he managed.

Jan Kowalczyk also held other responsible functions: he was a member of the Scientific Council of the IHKM PAN, in which he chaired the Section of Planning and

Evaluation of Scientific Research, he was the Chairman of the Committee of Evaluation and Reception of the Institute's Research Works (until August 1976).

An important part of his scientific activity during this period was editorial work. It was a difficult time in that the monumental five-volume synthesis *Prahistoria Ziem Polskich* [*Prehistory of the Polish Lands*] was being prepared, edited since 1975 by Witold Hensel. Jan Kowalczyk became a co-editor, along with Aleksander Gardawski (and after the latter's death in 1974 – an editor) of volume III: *Wczesna epoka brązu* [*Early Bronze Age*] (1978), which obtained the team award of the Scientific Secretary of the Polish Academy of Sciences. In 1976, after the death of Professor Z. Rajewski, he was also the editor-in-chief of the periodical *Archeologia Polski*, a position that he held until the end of 1978. In that time, three volumes appeared: vol. XXI/2 (1976), vol. XXII/1–2 (1977) and vol. XXIII/1–2 (1978).

Administrative and especially editorial duties affected the number of individual publications of Jan Kowalczyk. The latter mainly included synthetic thematic entries in the collective work *Encyklopedia sztuki starożytnej: Europa, Azja, Afryka, Ameryka* [*Encyclopedia of ancient art: Europe, Asia, Africa, America*], published in 1974: "Neolithic", "Globular Amphora culture", "Pit-and-Comb Pottery culture", "Corded Ware culture", "Danubian cultures", "Bell Beaker culture", "Tripolye culture". This publication, preceded by the introduction of Kazimierz Michałowski, contains 1500 entries and rich, colourful illustrative material, and is a joint work of Polish researchers: archaeologists and art historians. It is a valuable contribution to the achievements of the sciences researching the past, different from previous syntheses, among other things, in taking into account – beside the Middle Eastern civilizations and those of the Mediterranean basin – also contemporary cultures from other parts of Europe.

Jan Kowalczyk was also the author of the *Introduction* to, and at the same time the editor of, an important monographic publication *Cmentarzysko kultury amfor kulistych w Złotej Sandomierskiej* [*Cemetery of the Globular Amphora Culture in Złota Sandomierska*] (1977) – this was a return to his earliest research interest in the funerary rituals of Neolithic societies, especially those related to the GAC.

In spite of many absorbing and time-consuming activities at the Institute, Jan Kowalczyk did not resign from didactic work. In the 1976 academic year, he resumed lectures at the UMCS in Lublin and continued this activity until the end of his stay in Warsaw. In 1978 he also undertook the function of the PhD thesis supervisor of MA Witold Gumiński, handing him over materials from his own excavation research in Gródek. The dissertation, prepared in framework of the Doctoral Study at IHKM PAN and defended in 1983, was published in the series *Polskie Badania Archeologiczne* (Gumiński 1989).

In the general opinion of his collaborators, Jan Kowalczyk was a good man, and his attitude to people was always characterized by [...] *great kindness, and he always eager to give helpful advice for the younger employees of the Department* (from the opinion of Prof. R. Schild, 6/7/1978). This was reflected both in the jubilee texts prepared in

his lifetime (Balcer 1998) as well in later memories (Zakościelna and Gurba 2007; 2007a; Balcer 2015).

The merits of Jan Kowalczyk were also appreciated by his superiors, as evidenced by a congratulatory letter from the Scientific Secretary of the Polish Academy of Sciences, Prof. Jan Kaczmarek, from 19.07.1975, and the Golden Cross of Merit granted him by the resolution of the Council of State of January 5, 1979 for *outstanding merits in professional work and social activity* (resolution No. 0–2).

Jan Kowalczyk was undoubtedly an outstanding researcher. In the archaeological environment contemporary to his activity, in addition to the naturally debatable substantive issues, he was perceived as a person with great personal culture, bearing kindness towards collaborators, both colleagues in the field of science, and technical departments of both institutions, with which he was associated.

The research inquisitiveness of Jan Kowalczyk and his critical approach towards existing views are known. In question of Neolithic research, he presented a holistic, visionary approach. He formulated long-term research programmes resulting from the current scientific needs of his time (e.g. research on chronology), but which were adapted to the practical possibilities of their implementation. One of such programmes concerned research of the Sandomierz Upland, another one – of north-eastern Poland. The effect of the first one was, among other things, the excavations on several important Neolithic sites carried out under his inspiration: on the settlements of the FBC in Kamień Łukawski and in Zawichost at the site "Pieczyska – Zbrza Wielka", both in the Sandomierz district, and in the area of the flint mine in Świeciechów, Kraśnik district. They were run by young associates of "Mister Docent" from the Neolithic Department of the PMA: Dr Elżbieta Kempisty and Bogdan Balcer, realizing – albeit on a small scale – the idea of teamwork at its best.

One should also underline the didactic passion of Jan Kowalczyk, visible both in his almost constant cooperation with the university – his parent UMCS – but also in the approach to young collaborators, whether at work in the PMA or later – at IHKM PAN. He was also characterised by his kindness and empathy in relation to others. Bogdan Balcer regarded him as his teacher and master. He gave this expression many times, emphasizing that Jan Kowalczyk conducted his work *from student to docent* (Balcer 2015: 134). He always emphasized Jan Kowalczyk's careful supervision of his own scientific work, field activities and his kindness in personal matters. He stated that in the profession, he owed him as much as he did to his parents in life.

The assessment of Jan Kowalczyk as an investigator of the highest rank and at the same time a man friendly to the academic environment in which he worked, is underlined by respectful and friendship jubilee memorial writings published in the Lublin and Warsaw centres.

Translated by Andrzej Leligdowicz

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Polish Mesolithic Pots. Jasiu Kowalczyk – *in memoriam*

Stefan Karol Kozłowski[a]

The article deals with making of pottery among the European Mesolithic communities. The author, referring to the terminological proposal of Jan Kowalczyk – "ceramic Mesolithic", follows in this respect the development of research and the evolution of views of Polish Stone Age researchers.

KEY-WORDS: Jan Kowalczyk, ceramic Mesolithic, Neolithic, Janisławice culture, Niemen culture, Funnel Beaker culture.

Jan ("Jasiu") Kowalczyk was born in the Lublin countryside in 1918. He was a would-be student of naval construction at the Gdańsk University of Technology, a volunteer defender of Lublin in the famous September of 1939, a believer, gentle, kind and wise, a father with a tragic post-war history.

He learned archaeology in post-war Lublin, choosing to study the Neolithic, first on a regional scale, then on a wider one. A great expert in Neolithic pottery, a man who loved people, calm, rather withdrawn, not to say... shy. And this "quiet" man in 1969, in the 34th volume of *Wiadomości Archeologiczne*, published his habilitation thesis on the beginnings of the Neolithic period in Poland (Kowalczyk 1969). A rather analytical and traditional study, which is now out-of-date, but in one aspect, at least on the scale of Polish archaeology – revolutionary. The revolutionariness/exceptionalism of this work concerns... the idea of a "ceramic Mesolithic". This was a thesis not quite new in European archaeology, but in Poland of those times, it was.

The idea was paradoxical. After all, the earliest ceramics are/must be Neolithic, and the lack of ceramics means of course "Paleolithic/Mesolithic" attribution! That is how it was seen at this time.

The great Gordon V. Childe had denied such thinking at some point, questioning traditional paradigms and formulating new ones. He proposed a new definition of the Neolithic (farmers and stock herders), based on economic criteria, and *per analogiam*

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of non-Neolithic/Mesolithic (hunters-gatherers). The consequence was the thesis about the possibility of existence of a preceramic Neolithic formation phase. At that time it was a revolutionary idea, but in the British prehistorian's reasoning it lacked its logical symmetry, that is, the complement 'from the other side'. After all, if the Neolithic could be "aceramic", i.e. defined not by means of a technical but an economic criterion, then probably the economically opposing Mesolithic, in some cases, could be "ceramic". Was this possible? A Ceramic Mesolithic? Well, just for the symmetry of a beautiful hypothesis.

After all as there is "bright", so there must be a "dark" as well, if something is big, something else must be small, when something is hot, something must be cold, if something was aceramic, something else should have been ceramic...

And it was Jan Kowalczyk who was reasoning in this way, following the British professor.

Almost no one in Poland cared for this idea, because the Polish archaeological 'establishment' at the time did not have the imagination of the modest researcher from Lublin.

The challenge had been thrown out... and it was as if forgotten – we had not grown up to his stature in those days. Today we are smarter.

Jan Kowalczyk wrote about the ceramic Mesolithic in his dissertation as follows: *The Polish territories are situated in the passage zone of Europe, between its southern and northern parts. In the North, agriculture and stockbreeding appeared later than pottery and therefore that phase can be called "the ceramic Mesolithic"* (Kowalczyk 1969: 67).

People read the work, a few reviews appeared, but the thesis did not meet acceptance in Polish archaeology, because it had gone beyond the logic of people sorting material in museums. In the mind of his contemporaries, everything that was early-ceramic, had to be by definition "Neolithic", and any microlithic flint material, which accompanied such an early "Neolithic" ceramic in the sands of the Polish Lowlands, obviously had to be "Mesolithic" The pottery sherds then went to the "Neolithic" museum shelf, and flint artefacts – to the "Mesolithic" one. And so it turned out that Poland had different "Neolithic"/ceramic cultures: "Comb", "Pit-and-Comb", "Pre-Finnish", "Baltic", ultimately "Niemen" [Neman] pottery cultures, the latter devoid of a flint industry.

This resulted from a deep misunderstanding of the matter. It was then assumed that Neolithic flint specimens should be dimensionally "large", "polished", and should have flat surface retouches, possibly "retouch in form of gutter", and such flints were not found in the company of "Pit-Comb pottery".

And the circle of misunderstanding was closed. Well, maybe not for everyone, I had a shy suspicion that the assignments of museum materials was incorrect in such cases, and today, along with Marek Nowak, I am sure about it. Here I refer to our latest book on this subject (Kozłowski and Nowak, in print).

Also Elżbieta Kempisty in the 1970s, abandoned the term "Neolithic" for "para-Neolithic", quietly accepting Kowalczyk's thesis.

Of course, understanding of the issues and possibilities of accepting the term "ceramic Mesolithic" are today in Poland, but also in Europe, more clear than in the time of Kowalczyk's publication, because we have in our country a whole series of sites being excavated or properly surface explored that are confirming the thesis of the late researcher.

Below I present basic information on these sites, first considering the sites of Central and Eastern Poland, characterised by flint inventories in the style of "Janisławician" tradition.

At the beginning, I place the stratified features in which ceramics have co-occurred in cultural layers with a late-Mesolithic flint industry. These are multilayer sites, "sealed" and well-dated by series of 14C determinations. Taking into account all possible methodological objections (doubts about post-depositional processes within and between layers), their homogeneity cannot be questioned. Stratified sites are situated near water reservoirs, which has led to the development of expanded coastal stratigraphies.

1. Grądy-Woniecko, Zambrów district
   The site was examined by Krzysztof Burek, and published by Adam Wawrusiewicz with colleagues (Wawrusiewicz *et al*. 2018). Over a large area was found a partly stratigraphically sealed (!), deposit of late-Mesolithic flint material with Neman ceramics in its subsequent, chronological variants. Flints of "Neolithic" type (definition see above) were not found. 14C dating, made among others samples of human bones and carbonized deposit on ceramic, place all material within the fourth millennium BC.
2. Dudka and Szczepanki, Giżycko district
   Two multi-layered sites excavated by Witold Gumiński provided Zedmar ceramics and numerous flint artefacts (Gumiński 1997; 1999; 2004). Contrary to the opinion of the explorer, these were typical items of Late Mesolithic Janisławice culture, which were accompanied by late triangular and heart-shaped arrowheads with surface retouch. There were also some pottery sherds of the Funnel Beaker culture (hereafter: FBC) as well as of the Brześć-Kujawski culture items.
3. The co-occurrence of the Janisławice material (and a few late arrowheads with a flat retouch) with the Neman pottery was also confirmed by the excavations by Hanna Więckowska, Zofia Sulgostowska and E. Kempisty in Sośnia (Kempisty and Więckowska 1983) and in Woźna Wieś, both sites in the Grajewo district (Kempisty and Sulgostowska 1991), as well as in Stacze, Ełk district (Kempisty 1984), by excavations of Andrzej Krzyszowski in Kuców, Bełchatów district with Linin-type pottery according to E. Kempisty (Krzyszowski 1995: 50–53), those of Piotr A. Olszewski

in Korzecznik, Koło district (Olszewski 1987), of Piotr Mitura in Wola Raniżowska, Kolbuszowa district (Mitura 1994), and finally of Zygmunt Szmit in Czerwony Borek XXIV (Słochy Annopolskie), Siemiatycze district and in Hryniewicze Wielkie, Bielsk Podlaski district (Szmidt 1929), as well as those of Krzysztof Cyrek in Łykowe (Cyrek 1990) and of Ewa Niesiołowska in Osjaków (Niesiołowska 1971) – both sites in the Wieluń district.

4. A few of the sites were excavated by Małgorzata Rybicka and Andrzej Pelisiak in Gostynin district (Rybicka 1995; Pelisiak and Rybicka 1998; material in the Archaeological and Ethnographic Museum in Łódź), on which has been stated the co-occurrence of the Neman and/or FBC (more often) pottery with Janisławice flint (plus macrolithic blades imported from the south). This material (devoid of slender microliths), was analysed and properly interpreted by Michał Dobrzyński in his PhD (Dobrzyński 2014).
   Where dating was obtained (Grądy-Woniecko, Dudka, Szczepanki, Korzecznik, Woźna Wieś, Sośnia, Gostynin Lake District), the material has to be placed within the IV and III millennia BC.
   Correlation between FBC and Janisławician also occurred in Kuców, Bełchatów district (Krzyszowski 1995) and Baraki Stare, Stalowa Wola district (Libera and Tymczak 1990).
5. In the Podlaskie Museum in Białystok there are collections from AZP (Polish Archaeological Record) research. Adam Wawrusiewicz shared with me a selection of 30 collections containing pottery of the Neman type. In almost all cases, flint material of Janisławician type had accompanied these sherds.
6. Similar flint material with Neman pottery, collected by Jerzy Siemaszko and Jerzy Brzozowski from the lower reaches of the Lega River, is located in the District Museum in Suwałki.
7. Collections of the State Archaeological Museum in Warsaw.
   Especially at the confluence of the Vistula and Bug-Narew rivers, as well as on the Narew, Elżbieta Kempisty indicates pottery of the Neman type and less numerous ceramics of the FBC (mainly collected by Stefan Krukowski), also in Linin style imitating Neolithic pottery. Pottery is accompanied exclusively by a flint industry of Janisławice type, published by Stefan K. Kozłowski (Kozłowski S. K. 1975).
8. The surface collections of Władysław Kasiński are kept in the Archaeological and Ethnographic Museum in Łódź and the depository of the Polish Academy of Sciences in Warsaw also present the same correlation.
9. Collections of Zygmunt Gloger at the Archaeological Museum in Cracow. The collections coming from the upper Narew are dominated by flint material of the Janisławician type, accompanied by pottery, mainly of the Neman type.

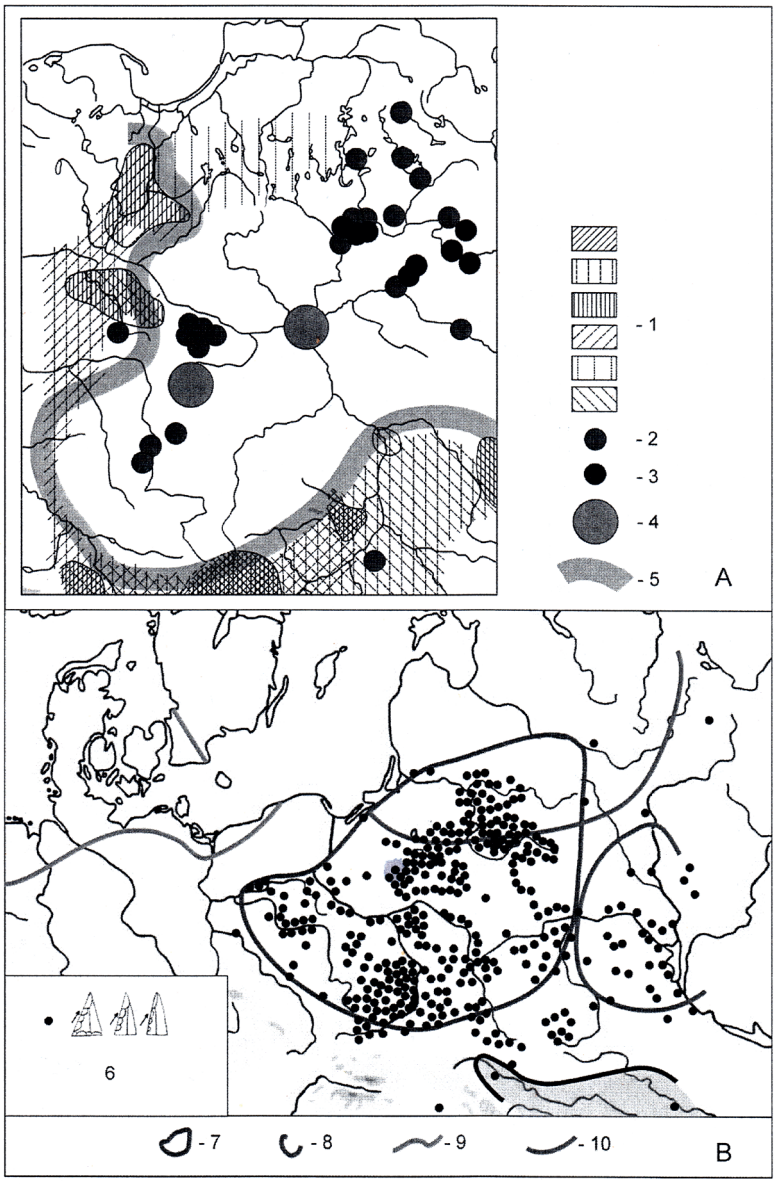

Fig. 1. Ceramisation of the Mesolithic of Central and Eastern Poland (according to M. Nowak and S. K. Kozłowski): A – similitudes between the views of both researchers: M. Nowak and S. K. Kozłowski: 1 – 1. "Bandkeramiker"; 2. Mesolithic: 2 – excavated sites, 3 – systematic surface explorations, 4 – old surface collections; 5 – Mesolithic-Neolithic border from the pre-Beaker period; B – Mesolithic ceramics: 6 – according to S. K .Kozłowski, 7 – according to M. Nowak; 8 – East Pripyat-river culture, 9 – Ertebølle culture, 10 – Narva culture.

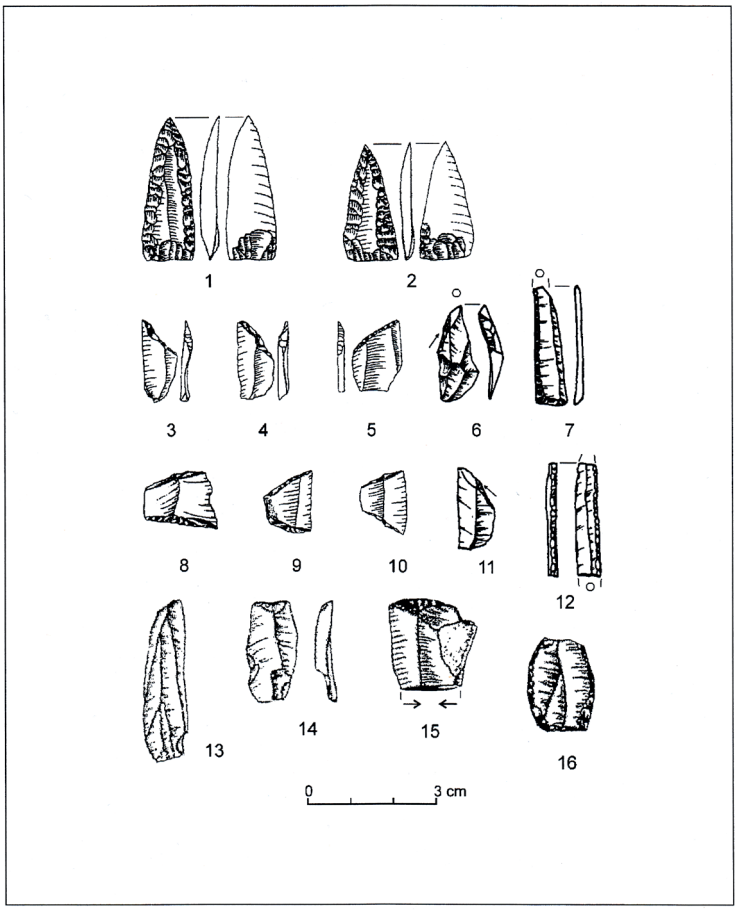

Fig. 2. Very late ceramisation of the Janisławician – Dudka and Szczepanki, Giżycko district; numbers 6, 7, 11, 12 come from a context containing Zedmar pottery (according to Gumiński 1997; 2004).

TIME AND TAXONOMY

The sites and groups of sites described in this short catalogue, omitting less reliable, older collections from the surface (in State Archaeological Museum – mainly those of S. Krukowski, in Archaeological and Ethnographic Museum in Łódź – of W. Kasiński and in the Archaeological Museum in Cracow – of Z. Gloger), suggest in an unambiguous way the immanent relations of "forest"/para-Neolithic ceramics (mainly the fourth millennium BC and later): Neman, Zedmar, Linin – with the regional

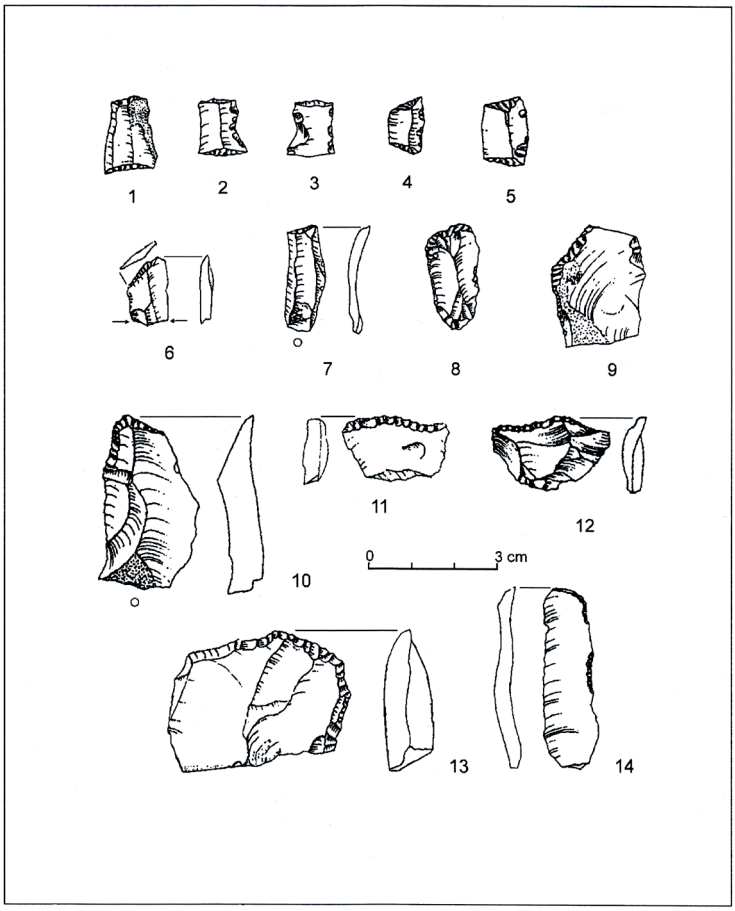

Fig. 3. Janisławician with Neman pottery – Łykowe, Wieluń district (according to Cyrek 1990).

Mesolithic industry – Janisławician, and on a larger scale of the country – with late Mesolithic.

We have the most data on this subject from Central and Eastern Poland, where such relationships are testified to by the stratified sites (Dudka and Szczepanki in stratigraphy with Zedmar pottery, and Janisławician at Grądy-Woniecko with Neman pottery), but also, methodically excavated sites (Sośnia, Woźna Wieś, Osjaków, Łykowe, Wola Raniżowska, Kuców, Baraki Stare, and others), and finally the sites from the Podlaskie Voievodeship and from the lower Lega River very methodically explored and recorded within the AZP (Polish Archaeological Record) project.

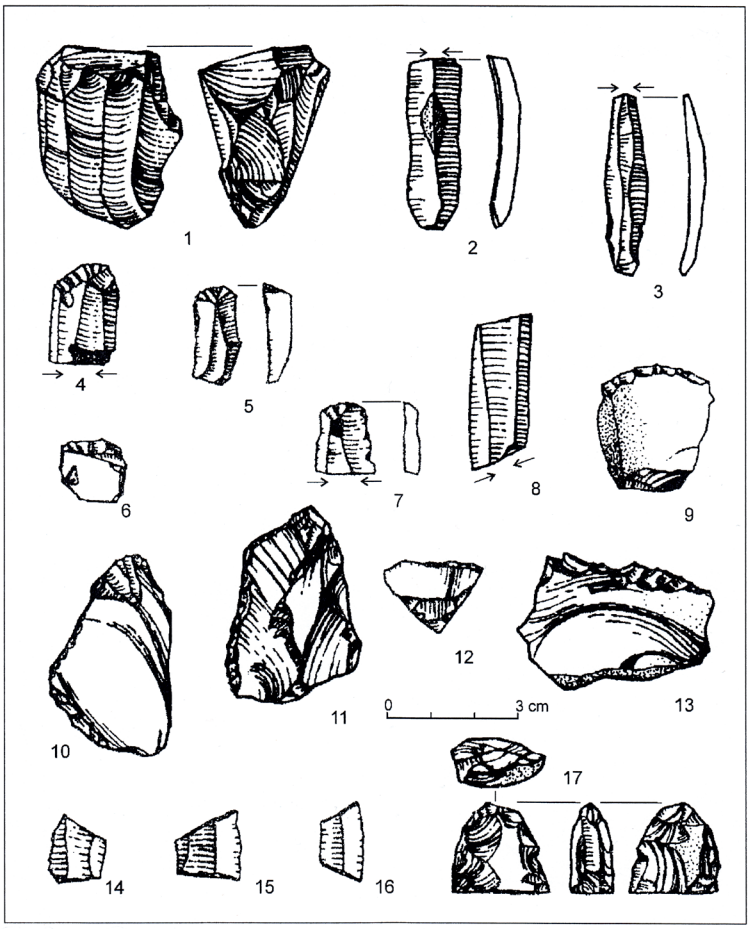

Fig. 4. Janisławician with FBC and Linin pottery – Kuców, Bełchatów district (according to Krzyszowski 1995).

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Thus, the relationship between the Polish Janisławician and the "forest" pottery is unquestionable, even if not all of the evidence cited is entirely accurate. Finally, it is confirmed by Janisławice elements, signalled by Mihail Charnyauski from Belarus (Charnyauski [Чарняўскі] 1987; 1997a; 1997b; 1997c; 2011), as well as by single points of the Janisławice type from the Latvian Dvina River (there in the context of Narva pottery – materials in the National Museum of Latvian History in Riga) and

Belarussian Berezina (materials of the Dnieper-Donets culture – data obtained from Russian colleagues).

There is also a cartographic argument for Polish territories: the territorial range of the Neman pottery in Poland, published by Bartosz Józwiak (2003, map 8), coincides with the range of Janisławice points, published by S. K. Kozłowski (1972; 1989).

To close the Janisławician case, two more pieces of information may be cited:

– the descriptions above prove the chronological parallelism of the Polish ceramic Mesolithic with the settlement of the Linear Pottery culture and of the Lengyel-Polgár complex in some areas of our country (among others, imports and imitations of Neolithic pottery at stratified Masurian sites).
– Janisławice flint elements, devoid of slender microliths, are encountered in some well excavated and documented FBC sites in the Polish Lowlands, outside the settlement area of the Linear Pottery culture (Gostynin Lake District and Łódź Upland) as well as in the Sandomierz Basin). We owe this important observation to, among others, Michał Dobrzyński (2014). This researcher indicates the presence in the Gostynin-region sites of macrolithic blades imported from the south together with Janisławice material. So far, they have been deposited in museums on the "Neolithic" shelf. Today we know that our Professors were wrong.
  We might mention here some similar observations, but for another late-Mesolithic tradition, in Western Poland (research by Michał Kobusiewicz, Zbigniew Bagniewski, Jolanta Ilkiewicz and Jacek Kabaciński), where together with the local late Mesolithic material occur:

– Ertebølle pottery: Dąbki, Sławno district in Pomerania (Ilkiewicz 1989; 1997; Kabaciński and Terberger 2009; Kabaciński *et al*. 2009; Kabaciński *et al*. eds 2015; Czekaj-Zastawny *et al*. 2011) and Chobielin, Nakło district in the Lubusz Land;
– FBC pottery: Dąbki in Pomerania (Kabaciński and Terberger 2009; Kabaciński *et al*. 2009; Kabaciński *et al*. eds 2015; Czekaj-Zastawny *et al*. 2011), Dąbrowa-Krępnica, Bolesławiec district in south-western Poland (Bagniewski 1979) and Chwalim (the upper layer), Zielona Góra district (Kobusiewicz 1981; Kobusiewicz and Kabaciński 1993).

Mesolithic pottery is not, of course, a purely Polish phenomenon, this is only part of a larger pattern. For the European Lowland, we will mention the classic Ertebølle, the Dutch Swijsterband, the East Baltic Narva culture, the Finnish Sperrings, the ceramic phase of the Butovian on the Upper Volga and the South Bug (Boh)-Dniester phase of the Grebiennikian on the Dniester, we will not miss the Dnieper-Donets culture in Southern Russia and the East Pripyat culture in Eastern Belarus. And in the south they will be: a large part of the Balkan-Italian *impresso* ware circle, most probably

French-Spanish *cardial* ware circle, or local, north-Italian ceramics such as Gaban, Vho and Fiorano.

Thus, it can be admitted that almost the entire continent, with the exception of the Balkan-Danube corridor (with the cultures of Starčevo-Kriş and Linear Pottery), has been "mesolitically" ceramised. It was the people of the Mesolithic who ceramised a large part of the continent, probably without any significant participation of those of the Neolithic.

Jasiu, so you were right more than 50 years ago, which was completely beyond the horizon of perception of your contemporaries. Today we admit it to you, because we have managed to prove it…

Translated by Andrzej Leligdowicz

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The Process of Neolithisation in South-Eastern Poland – Selected Problems

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The article is devoted to a critical discussion of the current concepts of the Neolithisation of Polish lands – from the migration models of colonisation to those that do not exclude the participation of the indigenous Mesolithic population in this process. None of the cited concepts explores the socio-cultural, internally conditioned, mechanisms of this epochal change. In the context of these mechanisms, one should look for the necessary and sufficient conditions for the change to occur, in the form of conscious (or more often unconscious) reinterpretation of symbols, norms and socio-cultural structures. This text outlines a fresh area to be explored in future studies of Neolithisation.

KEY-WORDS: Early Neolithic, Mesolithic, Polish lands, Neolithisation, Danubian cultures.

INTRODUCTION

The aim of the article is to outline a fresh area to be explored in future studies of Neolithisation. As a method of achieving this goal, the author reviews the most important, in his opinion, concepts of this process in Polish archaeology in order to reconstruct its sources and mechanisms. This review is to highlight the fields of achievement and deficiencies in these studies. As a result, this allows an indication of new, theoretical research perspectives. The aspect of genetic and isotope research was deliberately omitted when studying the process of Neolithisation due to the scarcity of relevant analyses from the area of Poland.

The review of views on the nature of the Neolithisation of Polish territories, presented in the archaeological literature from the 1920s to the present day, shows their significant evolution. The literature was initially dominated by migration models of colonisation of these areas by groups of the Danubian population. Later, the participation of the domestic Mesolithic population in this process was increasingly accepted.

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So far, the concept of existence of a Pre-Pottery Neolithic period in the Polish lands has not been confirmed.

HISTORICAL AND CULTURAL CONCEPTS

Włodzimierz Antoniewicz wrote (1928: 39) that around 4000 BC: [...] *the persistence of drought in the fertile Danubian steppes caused quite large groups of settlers to set off along the great riverbeds west to the Rhine countries; as well as north through Moravia to Silesia and to Lesser Poland. It was an agricultural people who also knew raising of bovine animals and swine* [...] As a result of population growth and rising droughts, followed the migration of this people to further forest-free and fertile areas [...]. The migration of human groups from the south (the Carpathian Basin) to the north (Lesser Poland) did not take the shortest route (through the Western Carpathians), but through Moravia (probably through the Moravian Gate), bypassing the chain of Carpathian Mountains from the west (Antoniewicz 1928: 39–40).

The views of the author of the first synthesis of prehistory of Poland (Antoniewicz 1928) are clearly inspired by Robert Gradmann's theory: *Steppenheidentheorie* (Gradmann 1906). However, the influence of Gustaf Kossinna on Antoniewicz's views is visible in his thesis that the division of the Early Neolithic cultural groups, made on the basis of stylistic and typological analysis of ceramics, corresponds to ethnic groups (Antoniewicz 1928: 40).

Józef Kostrzewski, a prominent student of G. Kossinna, saw a great economic breakthrough in the prehistory of Polish lands as an effect of the Neolithisation caused by the population from the central Danube migrating to these areas through the Moravian Gate. He calls this population "the folk of Banded Pottery [Bandkeramik]". He concluded that further wanderings of this people to the east (towards Volhynia) and to the south-east (towards Podolia) had taken place along the north and north-eastern borders of the Carpathian Mountains chain (Kostrzewski 1949: 29–30).

Konrad Jażdżewski also connected the appearance of the oldest Neolithic in Poland with the migrations of the agricultural populations from the area of Moravia through the Moravian Gate (Kostrzewski *et al.* 1965: 60–61). He believed that only the populations of the Bükk culture overcame the "Carpathian barrier" in their journeys from the Slovak-Hungarian borderland to Lesser Poland (Kostrzewski *et al.* 1965: 69).

According to Jażdżewski: [...] *ceramic styles within the Danubian complex are not an expression of differences larger than dialectical varieties within a large language unit or dissimilarity of clothing in different regions of the same population group, or a change in aesthetic preferences of successive generations of what is in principle the same community* (Kostrzewski *et al.* 1965: 60). This statement situates his views in the centre of cultural and historical archaeology, in which the normative concept of archaeological culture

is of key importance. In another place, he writes that [...] *in the first place should be exhausted all available sources indicating to the local development of individual cultures without unnecessary resorting, in the vast majority of cases to the migration theories while interpreting these phenomena* (Jażdżewski 1981: 292–294). This quote, in turn, reflects the specificity of the "indigenous school" in Polish archaeology. This, while developing from the Kossinna's *Siedlungsarchäologie* (and accepting most of its assumptions), rejects migrationism in favour of searching for local roots of the most important cultural phenomena. This position was a reaction to the involvement of *Siedlungsarchäologie* in the ideological struggle of the Nazis, seeking legitimisation of their political goals in the prehistoric past, in which the picture painted of prehistoric migrations of Germans had played a crucial role (cf. Lech 1998: 34–38, 48–54, 65–78; Kadrow 2011: 132; Kadrow 2014: 15–16).

The adherents of cultural and historical archaeology do not give reasons for the postulated expansion of the Danubian cultures population to the areas north of the Carpathian Mountains. On the other hand, as to the reasons for maintaining Trans- or Circum-Carpathian contacts in the Neolithic period and, above all, in the Bronze Age, they see them mainly in the need for obtaining raw materials (such as various kinds of flint, obsidian, amber, copper, etc.). The transmission of ideas and technology was therefore seen as a consequence of supplying themselves in raw materials.

In the 1960s, a group of archaeologists worked in Cracow attempting to establish the relative chronology and taxonomy of the Danubian cultures with reference to the "southern" standards (e.g. Kozłowski J. K. 1966; Kamieńska 1967; Kulczycka-Leciejewiczowa 1968). This group, focusing on the basic problems of the archaeologist's workshop – typology, taxonomy and chronology – consciously placed themselves outside the "neo-autochtonous school". The taxonomic and chronological results of their work (e.g. Kulczycka-Leciejewiczowa 1979: 34–39; Kaczanowski and Kozłowski 1998: 104–108; Nowak 2009: 89–93), with minor modifications, still function in Polish archaeology to this day. The disambiguation made at that time showed the importance of the Trans-Carpathian (and Trans-Sudetian) relationships, and the researchers mentioned above, without exception, opted for migrations of people from the areas south of the Carpathians and the Sudetes as the driving force of the emergence of the oldest Neolithic in our lands.

Such a basic approach, with some variations, was presented many times by Janusz K. Kozłowski, referring to the idea of adaptation. In his opinion, in the basin of the middle Danube in the middle of the sixth millennium BC a community of farmers and stock herders well adapted to the environment of dense forests had appeared. They produced and used ceramics decorated with incised bands. Due to the lack of evidence for demographic pressure in the starting areas, the migration of representatives of these communities to the north was seen as caused by the search for raw materials, mainly for the production of more "luxury" goods (e.g. Kaczanowski and Kozłowski 1998: 104).

Initially the groups of people migrating from the south (Pavúk 1980) occupied the loess areas in Lower and Upper Silesia and in Lesser Poland. A little later they arrived in the environs of Rzeszów, to Kuyavia and Chełmno Land. Then they reached western Ukraine and Moldova. The economic model of the population of the Linear Pottery culture in the north corresponds to the pattern of the economy previously developed on the middle Danube (Kaczanowski and Kozłowski 1998: 105; cf. also Czekaj-Zastawny 2008: 12–15; 2017: 26–27; Kozłowski *et al*. 2014: 39; Czekaj-Zastawny and Kabaciński 2017: 110).

PRE-POTTERY BEGINNINGS OF THE NEOLITHIC PERIOD IN POLAND

Jan Kowalczyk (1969) proposed as a thought experiment the hypothetical existence of a Pre-Pottery Neolithic in Polish lands. In the absence of any evidence for this phenomenon at that time, he developed this idea on the premises of general theories of cultural development; he also noted the poor state of the relevant research. This was the justification of the need to make an effort to actively search for traces of this phenomenon, which Kowalczyk (1969: 55–59) was convinced had taken place. Undoubtedly, he took his inspiration in this theory from the proposals of Vladimir Milojčić (1960).

Kowalczyk emphasized that the Neolithic was above all a continuation of the preceding epoch, and not just a revolutionary "leap" (Kowalczyk 1969: 57). He suggested that the beginnings of the Neolithic period in the Polish territories should be examined within three latitudinal zones: the southern, the central and the northern one, taking into account the specificity of north-eastern Poland (Kowalczyk 1969, Fig. 4–5). At the same time, he assumed that in these three zones, a Pre-Pottery Neolithic must have to preceded the pottery-using Neolithic. At the same time, he postulated that the southern zone should be regarded as the northern periphery of the area of the origin of the Linear Pottery culture (Kowalczyk 1969: 58).

In his deliberations, Kowalczyk was deeply rooted in the network of the concepts of cultural and historical archaeology. He considered the tribe to be the basic unit of the organization of human groups (Kowalczyk 1969: 63). This probably prevented him from developing properly his innovative hypothesis about the existence of the Pre-Pottery Neolithic in our lands. The whole concept at first met with severe criticism (Kozłowski J. K. 1971), to be later almost completely forgotten.

THE CONCEPT OF THE PRE-NEOLITHIC

Stefan K. Kozłowski (1989) noted that in the Late Mesolithic there can be detected a progressive standardization of flint industries. A tendency to increasingly use flint

raw materials of good quality is also observed. The starting point of these processes were (already in the seventh millennium BC) the Mediterranean areas and there they had their fullest and most expressive course (Kozłowski S. K. 1987: 13–17).

In the six millennium BC, these processes intensified. The production of trapezes, truncated blades, endscrapers and scrapers as well as of the larger and more regular blade blanks increased (Kozłowski S. K. 1987: 10; 2001: 267). These inventories resembled industries from the Early Neolithic period and therefore they were called "pre-Neolithic" (Kozłowski S. K. 1987).

In some Polish territories, the process labelled "pre-Neolithisation" consisted, according to S. K. Kozłowski, of the replacement of the Komornica culture with post-Maglemose cultures, and in the east of Poland – by the Janisławice culture, which had connections with the Black Sea area (Kozłowski S. K. 1989: 154–165; 2001: 267). However, the researcher found that [...] *the "progressive" pre-Neolithic character of the Janisławice culture did not develop later in the Neolithic direction because* [...] *the territory that it occupied was "unfavourable"* (Kozłowski S. K. 1989: 201).

"THE INITIAL PHASE OF THE RECEPTION OF THE MANUFACTURING ECONOMY"

In Kuyavia, at the site 29 in Dęby in the Radziejów county (Domańska 1990), bones of domesticated animals (mainly small ruminants) were discovered along with Mesolithic flint artefacts belonging to the Janisławice culture. This inventory was dated to the end of the seventh millennium BC. The discovery of this site became the basis for the separation of the initial phase of the process of reception of the manufacturing economy (Domańska 1990: 7; 1991; 1998). In this phase, "eastern" elements (remnants of small ruminants) were registered, which were supposed to testify about the participation of Caucasian-Black Sea cultural patterns in the formation of the initial phase (Domańska 1990: 62). The acceptance of Lucyna Domańska's conclusions would mean that in this case we are dealing with the oldest trace of the manufacturing economy, which, moreover, is not related to the Danubian cultures circle (cf. Nowak 2009: 82).

These theses raised many objections. Among others, it was pointed to the fact that the archaeozoological identifications are questionable (eg. Nowak 2009: 82). Others suggested that the described assemblages were not of a homogenous nature (Kozłowski S. K. 1991: 26). In reply to these criticisms, Domańska presented the results of the pedological and stratifigraphic analysis of the site that had yielded an interesting collection of artefacts, as well as radiocarbon dating results that allowed her to combine this collection with the Janisławice culture and the period 5300–4800 BC (Domańska 1991: 40–41). It seems, however, that at the level of source criticism, this dispute is difficult to resolve (cf. Czerniak 1994: 9).

This hypothesis is mostly falsified by the late dating of the few remains of goat/sheep in the Bug-Dnieper culture in the Black Sea basin (opinion of Norbert Benecke quoted by Klaus-Peter Wechler: Wechler 2001: 34–45; Kadrow 2007: 257–259), from where the impulses for the existence of the "initial phase" in the Kuyavia region could come from.

PRE-LINEAR AGRICULTURAL COMMUNITIES IN THE POLISH LOWLANDS

The view about the emergence of elements of the manufacturing economy before the Danubian colonisation is supported by the entire research stream in studies on the Mesolithic and the beginnings of the Neolithic, in which emphasis is on the fluidity of the boundaries between some types of foraging and hunting and agricultural and stock herding activities (e.g. Clarke 1976; Dennell 1983), in contrast to concepts of a sharp Neolithic Revolution postulated by Vere Gordon Childe (1929).

Lech Czerniak (1994: 7–16), however, also considers that a positive verification of the hypothesis assuming the emergence of elements of the manufacturing economy in the Polish Lowlands before the Danube colonisation can be expected, provided that a larger number of sites of Dęby 29 type will be discovered and investigated (Czerniak 1994: 11). In the light of the several ideas discussed above (e.g. Kowalczyk 1969; Kozłowski S. K. 1989; Domańska 1990; 1991; 1998) this is a promising research perspective. However, it is difficult to implement from the practical side (cf. Kozłowski S. K. 1989).

Czerniak claims that *in parallel with the formation process of Neolithic communities in the Middle East there was (the question is, whether fully independently?) a process of functionally similar socio-cultural changes among many local gatherer-hunter groups in Europe* (Czerniak 1994: 11). This phenomenon has also been described as a form of "pre-Neolithic" (Kozłowski S. K. 1989).

Positive verification of this hypothesis would also require demonstrating that the (pre- or proto-Neolithic) Janisławice culture had its beginnings no later than the end of the seventh millennium BC, and that its population was already in contact with the sheep breeding communities inhabiting the Dniester and the Southern Bug (Boh) basin (Czerniak 1994: 12). Radiocarbon dates, confirming the early dating of the Janisławice culture, and the fact of its adjacency (of the Janisławice-Rudoostrov circle) to the Bug-Dniester culture, make this thesis very probable. It is reinforced by the obvious influence of the Körös culture readable in the oldest ceramics from the Dniester and Southern Bug (Boh) basin. Knowledge of breeding small ruminants could, therefore, have been adopted from the population living in these areas, and not from the Crimea (as references in the Janisławice flint working seem to suggest), but through the Grebienniki culture (Czerniak 1994: 12–13). Eventually, Czerniak opts for the

Körös-Linear Pottery cultures origins of goat/sheep presence at the site 29 in Dęby (Czerniak 1994: 15).

AN INDIRECT ADAPTIVE CONCEPT

In the Neolithisation of Central Europe, including Poland, the Balkan areas played a decisive role. The discussion about the origin of the oldest Neolithic in Poland and in neighbouring areas has recently been presented by Marek Nowak (2009: 82–87). There are two alternative solutions: colonisation (e.g. Bogucki 2001; 2003; Kaczanowska and Kozłowski 2003) or adaptation (e.g. Mateiciucová 2004; Whittle 2004). There is also no lack of intermediate interpretations (e.g. Gronenborn 1999; Bánffy 2004; Nowak 2004).

According to the "colonisation" concept, the population of the oldest phase of the Linear Pottery culture, which were formed south of the Carpathians and Sudetes, relatively quickly migrated to the loess areas located on the north side of those mountain ranges and settled there in enclave areas. The main argument of this concept is the lack of any local roots of the Neolithic culture elements. The second is the similarity of the oldest pottery of the Linear Pottery culture to vessels of the Starčevo culture (e.g. Pavúk 1980).

The problem is the still poorly documented stage of the formation of the oldest phase of the Linear Pottery culture, i.e. the appearance of its characteristic ornamentation, the localization of this stage and its exact chronology (Nowak 2009: 83).

An important problem is also the issue of the causes of the far-reaching migrations of populations of this culture in its older phase to the north, north-west and north-east. In previous research the demographic (e.g. Cavalli-Sforza and Cavalli-Sforza 1995), ecological-economic (Bánffy 2004), socio-symbolic (Pavlů 2004; Pavúk 2004) or climatic factors (Strien and Gronenborn 2005) have been proposed as the reasons for these migrations. Nowak assumes also the possibility of existence of all the reasons mentioned, and not just one of them (Nowak 2009: 84).

In the migration model, the total lack of participation of local Mesolithic communities in the colonisation is also mysterious (Nowak 2009: 84).

There are several different versions of the "adaptive" concept. The radical versions completely reject the participation of migrants from the south (e.g. Whittle 1996). The indigenous hunter-gatherer populations are thought to have independently adopted the "Neolithisation attributes". In this way they created an original cultural (economic, settlement, social and ideological) quality different from the Balkan one. The weakness of this idea is, according to Nowak, the lack of evidence that would justify it in the sphere of material culture (Nowak 2009: 85).

The intermediate versions of the adaptive concept are more convincing (e.g. Gronenborn 1999; Bogucki 2000: 197–218; Zvelebil 2004). They accept that there was most probably a migration *to the north of a population of Starčevo-Körös origin, who invented linear ornamentation* (Nowak 2004; 2009: 86). They settled in enclaves in central Europe in the oldest and older phase of the development of the Linear Pottery culture. These communities were to be the "leaven" of the Neolithic among the Mesolithic population groups, especially in the western zone, on the basis of contact at "fronts" (Bogucki 2000: 218; Zvelebil 2001: 6; Nowak 2009: 86–87). The low intensity of contacts between Mesolithic and Early Neolithic groups is underlined. In Polish territory this is demonstrated by the occasional presence of amber on the sites of the Linear Pottery culture (Czekaj-Zastawny and Kabaciński 2017: 110–111).

CONCLUSIONS

In the concepts quoted above, little space was devoted to the mechanisms of Neolithisation and civilisation changes accompanying it. Sometimes such reflections were limited to pointing out external factors towards the communities involved in the process, in the form of climatic changes (more broadly: environmental) or economic changes that acted as necessary but insufficient conditions for any change (cf. Habermas 1983: 494; Sztompka 2007: 208–212). None of the cited concepts, however, refers to the socio-cultural, internally conditioned mechanisms of this epochal change. In the context of these mechanisms, one should look for the necessary and sufficient conditions for a change to occur, in the form of conscious and more often unconscious reinterpretation of symbols, norms and socio-cultural structures (cf. e.g. Kadrow 2012: 227–228). This statement outlines a fresh area to be explored in future studies of Neolithisation. An attempt to implement them is a reconstruction of the mechanisms of changes taking place in the Early Neolithic communities in the Rzeszów region (Kadrow 2019).

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Pottery of Pikutkowo Style and the Processes of the Eneolithisation of "Megalithic Cultures" in the 4th Millennium BC

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The authors discuss the current state of knowledge concerning the specific pottery features of the Funnel Beaker culture (FBC) that constitute the "cycle of Pikutkowo stylistics". These characteristics are especially strongly represented in the Kuyavia region where the changes in the "Pikutkowo" set of characteristics define phases III B and III B–C of the FBC, dated to 3700–3200 BC. Relatively quickly, because already in the period 3700–3600 BC, "Pikutkowo" pottery appears not only in the Polish Lowlands (including Greater Poland and Central Poland, as well as in the Chełmno Land and the Gostynin Lake District), but also in the old upland areas located in the upper Vistula basin. The latest data indicate that at the same time "Pikutkowo" characteristics are also present in FBC assemblages from the Subcarpathian foothills, as well as from the upper Dniester.

In the final centuries of the first half of the fourth millennium BC, "Pikutkowo" features were resent with varying intensity within the borders of the Vistula and Odra catchment area in the west and the Dniester drainage basin in the east. The authors argue that this wide distribution designates the "Pikutkowo stylistics space", which was a zone of active circulation of cultural patterns within the FBC. The culture-forming potential of this zone is best confirmed by the phenomenon of the transfer of one of the key innovations at the time, i.e. copper (including arsenic copper) processing.

KEY-WORDS: Funnel Beaker culture, pottery ornamentation, zone of Pikutkowo stylistics, adaptation of copper/arsenic copper.

The starting point for the considerations contained in this article are the comments of Jan Kowalczyk, presented in his habilitation monograph (Kowalczyk 1969), and re-read on the centenary of the birth of this still-inspiring scientist. One of the significant and at the same time disputable threads of J. Kowalczyk's thought was the attempt to analyse the concept of the autogenesis, including particularly the identification of the topogenesis of the Funnel Beaker culture (FBC), which was for him a key problem in Polish studies

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on the Neolithic period. This approach to the problem of the FBC largely resulted from his experience of researching its "large settlements" in the old-upland (loess) part of the Vistula river basin (e.g. Ćmielów in Ostrowiec Świętokrzyski district, and especially Gródek in Hrubieszów district – this site in literature is referred to as "Gródek Nadbużny"). It was also a consequence of the author's concept of revising the idea of the "northern genetic centre" of the FBC as suggested by Carl J. Becker. As a result, J. Kowalczyk realised: *accepting the view of C. J. Becker, generally speaking, of the later date of the northern Danish group in relation to more southerly located areas, imposes the necessity to distinguish and recognise in succession the older phases of this culture and the more older, the further south we move*, concluding himself ultimately, *that the oldest elements of the FBC should be sought in the southern group,* i.e. in Lesser Poland (Kowalczyk 1969: 36).

By applying this approach to the material evidence, J. Kowalczyk stated: *already the very general features of the vessels of the "oldest phase of the Linear Pottery culture" themselves correspond above all to the ornamental tendencies of the FBC ceramics. There is here a rule of the same frugality in decoration, the very clear domination of fingerprints, especially in the large group of wide-open (baggy) vessels, plastic ridges and of course the clearly separated vessel bases* (Kowalczyk 1969: 43, with emphasis by the authors).

From the 1970s, Kowalczyk's evaluation was the inspiration for studies on the southern genesis of the FBC pottery styles, or more strictly: inscribing them into the old-upland cycles of "linear" or "postlinear" ceramic styles. In the first case, it was the concept assuming the links of the early FBC to the Podgaj type cultural assemblages (Kośko 1980; Czerniak 1988; 1994), while in the second case this refers to an attempt to refer the early FBC to the Lengyel-Polgár cycle from Lesser Poland and to the Malice culture (Kukawka 2015).

In this paper, we intend to outline the third trend, diverging from previous discussions connected with research on the genesis of the FBC. Our main focus is on the question of what kind of autogenetic position was played in the development of the FBC by "pottery with frugal ornamentation", which has previously been classified as typical of groups in "Lesser Poland" or as diagnostic for the south-eastern group. At the same time, we switch our focus to the area of Kuyavia, where a series of important taxonomic and cultural observation have been made over the past few decades (e.g. Kośko 1981; 2000; Kośko and Przybył 2004; Kośko and Szmyt 2006; 2007a; 2007b; 2014; 2015). Because the Kuyavian settlement and cultural mesoregion occupied a special position in the circulation of cultural patterns in Central and Eastern Europe, the conclusions about its taxonomic features have significance for studies of the cultural phenomena over more extensive areas.

THE KUYAVIAN PERSPECTIVE: THE CONCEPT OF THE PIKUTKOWO STYLISTIC CYCLE

In the Kuyavia region, the beginnings of identifying pottery with frugal decoration with the FBC should be associated with the work of Ewa Niesiołowska, who in the study of materials from the site Pikutkowo 6 located in eastern Kuyavia, Włocławek district (Fig. 1) included the concept of the Pikutkowo phase as *the initial stage of the Wiórek phase* (Niesiołowska 1967: 121). In later years, Lidia Gabałówna (1968: 143; 1971: 249) and Tadeusz Wiślański (1979: 177) made reference to her work, creating the outline of two developmental stages as part of the second phase of the FBC: the older labelled the "Early Wiórek or Pikutkowo" and the later the (main) "Wiórek phase".

Gabałówna characterised the Pikutkowo style in 1968 as consisting of sparsely ornamented ceramics, accentuating the presence of such decorative elements as rows of rectangular stamp, zigzags, ladders and fingerprints, and among the macromorphological characteristics – collared flasks (Gabałówna 1968: 143). In her later works, the cited author used the observations of Waldemar Chmielewski (1952) and her own ones from Sarnowo site 1 and 1A, Włocławek district, and also of E. Niesiołowska from Pikutkowo site 6, for the distinction of transitions from the AB phase to *the Wiórek phase understood in extenso* (Gabałówna 1971: 249). In an article published posthumously in 1971, she made a remark about the presence *of an increasingly distinctive group of materials*, which she once named temporarily "early Wiórek". In conclusion she stated: *I would propose calling this Wiórek phase the Pikutkowo phase* (Gabałówna 1971: 250).

Wiślański (1979: 177) introduced the concept of the Pikutkowo phase to the taxonomic terminology, while maintaining the ambivalence and terminological uncertainties of earlier writers, saying: *in assemblages that can be associated with the Pikutkowo stage, "archaic" features having very clear connections with the A/B phase relatively commonly occur*.

In developing this concept, based on new evidence (in particular from the site Inowrocław-Mątwy 1, Inowrocław district, located in the central zone of the Kuyavia region), a taxonomical approach to the Wiórek-Pikutkowo style has been proposed – it was used to define sub-phase IIIB of the local FBC, characterised as a state of *"periodic" growth, among the technological and stylistic features of the ceramics of Eneolithic tradition belonging to the FBC groups of Lesser Poland and the late stage of the Tripolye culture* (Kośko 1981: 48; 1988: 164). A hypothesis was also formulated about the eastern Kuyavian stylistic region (Kośko 1981: 62f.), with which the eponymous site Pikutkowo 6 was associated, as the Kuyavian equivalent of the pottery styles of Bronocice II in Lesser Poland or Jevišovice C2 in Moravia (Kośko 1988: 165).

The next stage of understanding the position of ceramics with frugal decoration in Kuyavia was reached in research on the so-called large settlement in Dąbrowa Biskupia site 21, Inowrocław district (the older stage of settlement on the site according to Piotr

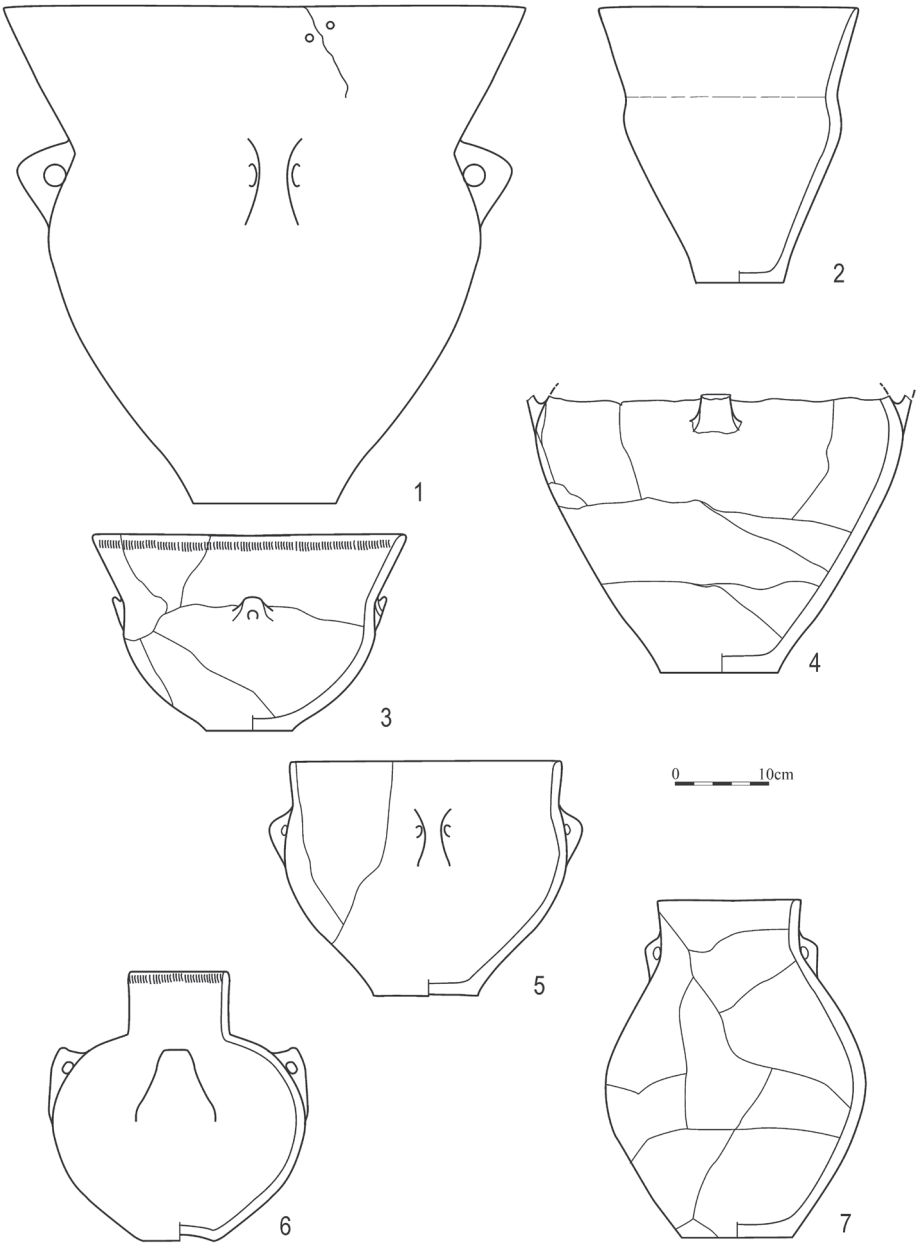

Fig. 1. Pikutkowo site 6, Włocławek district. Vessels from pit 25. By Niesiołowska 1967. Redrawn by B. Bednarczyk.

Chachlikowski, whom we kindly thank for information), and then exploration of features on the routes of new linear investments (pipelines and roads) crossing the Kuyavian Plateau, including, first of all, the site at Bachorce 4, Inowrocław district. This led to the development of the concept of a cycle of subphases in the development of the Wiórek-Pikutkowo style: *IIIB (classical Pikutkowo) and IIIB-C (late Wiórek) = 3700 – 3500 – 3200 BC = styles Inowrocław-Mątwy stage A; Dąbrowa Biskupia 21, phase I; Bachorce 4* (Kośko and Przybył 2004: 256f.).

The latest stage of the development of ideas, initiated in the 21st century, is associated with studies on the cultural image of the Kuyavia region in the middle of the 4th millennium BC. It can be examined from three positions taking as a starting point the research projects at: (A) Opatowice, (B) Brześć Kujawski and (C) Wilkostowo.

A. The investigations carried out in 1983–1998 on Prokopiak Mount in Opatowice, Radziejów district, in the central part of Kuyavia (Kośko and Szmyt 2006; 2007a; 2007b; 2014; 2015) are of key significance for the topogenetic qualification of the above-mentioned taxa (i.e. subphases IIIB and IIIB–C). A set of components (identified with the stylistic traditions of the FBC) that were recognised in the local pottery production can be read in terms of a record of long-distance and neighbourly ties. In this programme, an attempt was made to embed a large series of taxonomic observations in the context of the currently discussed concept of the autogenesis of the FBC settlement of the Kuyavian mesoregion. In the light of these studies, in the period of 3650–3200 BC, the FBC Kuyavian communities, genetically identified with the eastern agglomerations (i.e. with the Eastern Group) of the large-valley mesoregion, were subjected to two-way external cultural inspirations. These ran: (a) meridionally between the Vistula and Warta-Upper-Odra basins and Moravia, and (b) latitudinally between the Warta basin (Greater Poland) and the Saale – Elbe drainage basin.

Attention should be focused on inspirations from the Moravian region, dated to 3650–3500 BC and recognised in their initial version at the site of Opatowice 33 (strictly: in the phase/settlement Opatowice 33–A1). The pottery traits there are continued by the "Łojewo" trend of the local FBC assigned to the phase IIIA (Szmyt 1992; Czerniak and Kośko 1993: 105; cf. the style FBC s2b – Rzepecki 2004: 49). These have numerous references to the traditions of the south-eastern group, both from the loess areas (local phases: Bronocice II, Zimne I, Gródek Nadbużny I; cf. Kruk and Milisauskas 1983; 2018; Bronicki *et al.* 2003), as well as from the so-called para-lowland zones (Czopek and Kadrow 1987; Nowak 1996; 2001). There are also clear references to more distant agglomerations of the FBC (Fig. 2). These include the Moravian-Upper Silesian subgroup (the older phase – Jevišovice C2; cf. Bukowska-Gedigowa 1975; Medunová-Benešová 1981; Šmid 2017), and even the Baalberg group from the Czech Basin (from the younger phase, with stamped

Fig. 2. Sites with pottery of "Pikutkowo" traits and copper daggers in the contextof the distribution of basic territorial groups of the Funnel Beaker culture.
Map by Midgley 1992, amended by the authors and redrawn by B. Bednarczyk.
Key: a – sites with pottery of "Pikutkowo" traits; sites mentioned in the text are numbered (1 – Bronocice 1; 2 – Gródek 1; 3 – Zimne 1; 4 – Skołoszów 31; 5 – Pliszczyn 9; 6 – Kotoryny-Grodzisko III); b – finds of copper daggers in the context of the Funnel Beaker culture (7 – Kałdus; 8 – Gaj 1; 9 – Słonowice 5); c – Kuyavia.

ceramics – Sířem; B1; cf. Pleslová-Štiková 1985; 1987). These convergences concern the advanced (Eneolithic) techniques of surface elaboration (e.g. slipping) and the firing of the vessels as well as their stylistic features identified as "classic Pikutkowo" (Kośko 2006: 191–192).

These features can be summarized in the form of a model of the technological--stylistic basis for the Pikutkowo style zone, present both in Kuyavia area as well as in the south Polish uplands (cf. below). The basic packet ("classic Pikutkowo" = phase III B) can be defined, in idealised form, as the co-occurrence of the following set of diagnostic attributes:

- technology – the presence of **slipping** (diagnostic feature) + well smoothed surface, possibly also strong firing;
- macromorphology – the presence of typological groups of **funnel beakers** (diagnostic feature) + amphorae + collared flasks + pots + bowls + vases;

- ornamentation – the presence of **rows made with a rectangular ("orthogonal") stamp and placed in the zone under the rime** (diagnostic feature) + under-rim rows made with comb + under-rim applied clay strips with fingertip impressions + elements placed on the belly of the vessels (rectangular stamps, applied zig-zags, knobs, ladders).

In the "late Pikutkowo" stage (= phase IIIB–C), diverse deviations taking many regional forms can be observed in the stylistic package described above. Their detailed recognition is still an important analytical task, both taxonomic as well in terms of cultural studies (cf. below).
An important development of the programme under discussion is current research on the chronometric characteristics of the eastern Kuyavian stylistic region based on evidence from the research on the A1 motorway route, as, for instance, at the site Janowice 2, Włocławek district, dated to 3580–3530 BC (Kośko and Żurkiewicz 2016: 142–144) and other features (e.g. Rzepecki and Golańska 2015; Grygiel 2016). Some of them can be interpreted as a confirmation of the phenomenon of "peripheral atavism" (cf. Kośko1981).

B. Research conducted in eastern Kuyavia in the area of Brześć Kujawski, Włocławek district (Grygiel 2016; 2018), has led to modifications to our knowledge of the Middle Neolithic FBC (Rzepecki 2004), situated in the space of influences both from the west (to the "large valley" type, mainly in relation to the *Mittelelbe-Saale Gebiet*) and the north-west, from the genetic centre in the eastern Holstein region and southern Jutland, dated to around 4200 BC (Grygiel 2016: 970f; cf. Nowak 2009). In this perspective, the developmental context of the Brześć Kujawski culture is minimized, it is separated from the prologue of the Kuyavian FBC (about 3900 BC) by a distinct "chronological break" (Grygiel 2016: 996, Tab. 91; 2018: 197, Fig. 10). An important novelty in this period are numerous stylistic references to the Lublin-Volhynian culture, the second of the basic centres of "Eneolithisation of the Polish Lowland", genetically distinct from the "Lengyel tradition" present in the Brześć Kujawski culture. For example, according to R. Grygiel, in material from the Smólsk site *are legible the influences of the Lublin-Volhynian culture, discovered in several rubbish pits and one inhumation grave, in the form of well copied vessel patterns of the LVC, as well as the appearance of large amounts of chocolate flint at sites of the early phase of the FBC, the main, and then perhaps only group with access to its deposits, were precisely the "Lublin-Volhynian" communities living there* (Grygiel 2016: 973–974). In conclusion, the author suggests verification of the existing knowledge on the significance of this cultural unit of the Middle Neolithic that is still probably too little known and thus underestimated (Grygiel 2016: 974).

In the local sequence of the FBC from the Brześć Kujawski region, three phases are distinguished (Grygiel 2016: 966, Tab. 91, Fig. 687): early – 3900/3800–3600 BC (corresponding to I–IIA phases in Central Kuyavia), classical – 3650–3400 BC (= phases IIB–IIIC, as above), and late – 3400–3200/3100 BC (= phases IVA–VB, as above).
The "Brześć" sequence also refers directly to the eponymous site of Pikutkowo 6, classified by R. Grygiel as the prologue of the classical phase. Two radiocarbon dates were obtained for bone from graves, which confirm the occupation of the site in two phases: in the period 3737–3644 BC and 3628–3589 BC, already perceived by E. Niesiołowska (Grygiel 2016: 151).

C. The archaeological research at the site Wilkostowo 23/24, Aleksandrów Kujawski district, revealed a stable settlement of the FBC, from the mid-fourth millennium BC – 3525–3450 BC (Rzepecki 2014: 335). Thanks to large scale excavation, we have a relatively comprehensive record of the everyday and occasional life of Kuyavian communities of the FBC at the turn of phases IIIB and IIIB–C (Rzepecki 2014; 2015). From the perspective of the issues of the Eneolithisation of "megalithic cultures", an essential phenomenon is evidence of the lack of the use of copper. It should be noted, however, that a similar programme of "large settlement" research in Dąbrowa Biskupia, site 21, the oldest stage of the development of which coincides with phase IIIB, revealed the presence of this metal, albeit in a small amount (Hensel 1988, Table 1). These phenomena should be interpreted in the context of "large settlements" from the loess upland regions of the South (cf. below).

"PIKUTKOWO ANALOGIES" IN OTHER REGIONS OF THE POLISH LOWLAND AND THE OLD UPLANDS

The extent of the phenomena related to the Pikutkowo style was significantly expanded due to the research on the FBC in the Polish Lowlands conducted in several regions. Among them are the Chełmno region (Kukawka 1991; 1997), the Gostynin Lake District (Rybicka 2004) together with central Greater Poland (Wierzbicki 2013), and also in central Poland – e.g. in the Grabia catchment (Pelisiak 2003). Material related to the Kuyavian phase IIIB has been identified in these areas, however, it is still difficult to include the results obtained in a detailed comparative analysis and to relate them to taxonomic findings from the central Kuyavian stylistic region (cf. above).

Another group of analogies that are inspiring involves those from the old upland areas (more strictly from the river basins of the upper Vistula and Bug), dated to the classic phase, which corresponds to the third Kuyavian phase (Włodarczak 2006: 34). It is worth recalling that this is the so-called stage of central places, i.e. the period of exis-

tence of large upland settlements of the Bronocice type (Kruk and Milisauskas 1999: 135). In the cited systematisation, the "classic Pikutkowo" period (phase IIIB) corresponds to the phase/style of Bronocice II, currently dated to 3750/3700–3500/3400 BC, while the "late Pikutkowo" period (phase IIIB–C) corresponds to the phase/style of Bronocice III, dated to the period 3500/3400–3300 BC (Kruk *et al.* 2018: 77; cf. Kruk and Milisauskas 2018: 79–85). The date 3500 BC marks the prologue of the Boleráz stage (Włodarczak 2006: 36).

In relation to the previously-cited observations from the Kuyavia region, the old upland zone has only a small number of stylistic sequences (from sites or microregions), which is one of the weaknesses of the taxonomic diagnosis of these areas. It is still limited to a few large settlements in Bronocice, Pińczów district, Gródek, Hrubieszów district and in Zimne, Volodymyr-Volynskyi raion (West Ukraine). Moreover, the situation is complicated by the conservatism of ceramic stylistics *which may be an additional difficulty in determining the periodisation of remains of the FBC settlement* (Rybicka 2017: 26).

The latest research results on the Subcarpathian foothills and in the upper Dniester area open new opportunities for research (Rybicka 2017, Fig. 8). In the light of current knowledge it is possible to state that the FBC communities appeared in the upper Dniester region *very early* (...)*, because about 3700/3600 BC, i.e. at a similar time as, or even earlier than, in the Bug River region* (Rybicka 2017: 26; cf. Bronicki *et al.* 2003; see also: Kadrow 2007).

It may therefore be stated in conclusion that in the region concerned (within the borders of the Vistula and Odra catchments in the west and the Dniester basin in the east), we have identified markers of the active circulation of cultural patterns in the form of the emergence of the "classic Pikutkowo stylistics cycle" in the final centuries of the first half of the 4th millennium BC. For this, the diagnostic sites are: Pikutkowo 6, Inowrocław-Mątwy 1/phase 1, Dąbrowa Biskupia 21/phase 1, Bachorce 4, Bronocice 1/phase II, Zimne 1 /phase I, Skołoszów 31, Kotoryny-Grodzisko III.

In view of the hypothetical date of the beginning of this activation process around 3700/3650 BC, the Eneolithic civilisational background for this process could at that time have been created by the waning of the Brześć Kujawski culture (in the north) and the Lublin-Volhynian culture (in the south) and the initial states of the lowland transmission of the Tripolye culture – since the CI/CII stage (cf. Diachenko, Harper 2016, there further literature) and of the Lesser Poland "proto-Boleráz" agglomerations of "Wyciąże" or "Niedźwiedź" type (Włodarczak 2006: 36–38, Zastawny 2008, there further literature).

Leaving aside the distribution of flint raw materials from the Volhynia-Dniester area in FBC assemblages of Lesser Poland, generally related to the Bronocice II-III horizon (Libera and Zakościelna 2011: 89f.), there is no satisfactory analytic evaluation of reception of the ceramic features identified with the Pontic Eneolithic. In the set

of cultural patterns considered Eneolithic within the old upland sites of the "classic Pikutkowo stylistics cycle", the Tripolye component was only faintly evidenced. These features have also not been seen in Bronocice II (Kruk and Milisauskas 1983; Włodarczak 2006: 57), although Małgorzata Rybicka recently recalled the remark of Janusz Kruk and Sarunas Milisauskas (1981: 98) that *in one of the features of the BR II phase there was a* (...) *ceramic fragment with a similar* [with respect to discoveries in the BR III and IV assemblages – A. K., M. S.] *ornament of red colour*. She pointed out that this may be a stylistic borrowing from the Tripolye culture circle (Rybicka 2017: 103). In addition, she underlined the Tripolyean provenance of pottery ornaments made of so-called double cord imprints found, for example, at the sites Skołoszów 31, Jarosław district (Rybicka 2017: 107f.) and Pliszczyn 9, Lublin district – here on ceramics dated to around 3550–3450 BC (Chmielewski T. J. 2015: 221). Anyway, the problem of the topogenetic context of the cord application in the FBC ornamentation has already been the subject of archaeo-technological studies (Kośko and Szmyt eds 2010).

A new direction in research may be marked by the finding of FBC ceramics with clear Wiórek phase connotations in the centre of the Baden culture area at Salgótarján-Pécskő, Nógrád district (Horváth 2018: 145–146).

THE CONTEXT OF "NON-TAXONOMIC" DATA FROM THE 4TH MILLENNIUM BC: BEGINNINGS OF METALLURGY IN THE CIRCLE OF "MEGALITHIC CULTURE" COMMUNITIES

We propose placing the process of gaining expertise in metalworking, recognized as a symptom of broader changes in terms of ideology and social organization, in the focus of current reflections on the Eneolithic appearance of the cycle of the Pikutkowo style, and especially its initial stage (3700/3650–3500 BC).

In the taxonomy of the Kuyavian FBC group, copper appears at the turn of phase I and II. This is evidenced by material from Sarnowo 1, Włocławek district (tomb 8), Leśniczówka 1, Koło district (tomb II) and from a settlement in Przybranówek 43, Aleksandrów Kujawski district (Gabałówna 1970: 83; Czerniak and Kośko 1993). In the current chronological framework, this would be a period with a maximum chronological spread between 4400/4200 and 3800 BC. In compliance with observations at Brześć Kujawski, the same process should, however, be dated to between 3900 and 3600 BC (Grygiel 2016, Fig. 687). In previous topogenetic conceptions, a cultural transfer between the Brześć Kujawski and FBC societies has been assumed (Gabałówna 1970: 86; cf. Kośko and Czerniak 1993; Czerniak 1994). While maintaining this diagnosis, it should be noted that in the region of eastern Kuyavia, within the "Brześć" societies, Ryszard Grygiel (2016: 981) assumed the development of the Brześć Kujawski culture took place certainly within the fifth millennium BC, while he dates the

appearance of the first wave of FBC migration only to the period of around 3900/3800 BC (Grygiel 2016: 981). Regardless of the chronometric discussions summarised above, the problem of the final caesura of the Brześć Kujawski culture remains undoubtedly closely related to the concept of the autogenesis of the Globular Amphora culture (cf. Szmyt 2017, with older literature).

It is also necessary to note the presence of copper objects on site 4 at Brześć Kujawski and on site 6 at Nowy Młyn, Włocławek district. They are linked with the classic FBC phase, i.e. after 3700/3600 BC. The results of metallurgical analyses prompted R. Grygiel to formulate the opinion that these items *do not differ significantly in chemical composition from the group of older products of the Brześć Kujawski group, they form here their own concentration between two assemblages of Lengyel culture. Analysis could therefore lead us to cautiously assume a continuity of development of the old centres of European copper working, from the mid-5th millennium BC* (Grygiel 2016: 925).

The oldest manifestations of local copper processing come from large settlements of the FBC of Lesser Poland, dated to the classic phase, in Niedźwiedź, Cracow district, Ćmielów and Gródek, *where copper slag has been discovered, in the last two sites also burnt foundry crucibles* (Wiślański 1979: 273; Gumiński 1989: 166–169). However, serious objections are raised regarding Ćmielów and Gródek (e.g. Kadrow 1998; Koziorowska 2006). The list of other evidence, also rather questionable, is wider (cf. Midgley 1992: 294, see there the older literature).

Therefore, it is probable that it was during the prologue of the Pikutkowo stylistic cycle that the beginning of copper processing can be seen in the FBC. Undoubtedly, the introduction of this material was a complex process, which is only now slowly and gradually becoming better understood as a result of archaeometallurgical studies (e.g. Kowalski *et al.* 2016; Kowalski *et al.* 2017). In this place we would like to draw attention to the results of the studies of Stefan Łęczycki who argued that identifiers of this process are the Bytyń type axes. The axes can be dated to the middle of the 4th millennium BC, through the ceramic context in Kietrz, Głubczyce district (feature 113: Jevišovice C2 – C2/C1 phase), as well as the imitation of the form of a lithic implement, shaft-hole axe with a button-like butt in Szczecin-Śmierdnica (Łęczycki 2004; cf. Szpunar 1987) According to the same author's opinion, *axes of Bytyń type belong, in the majority, to the E01 group*, which correspond to the use of arsenical copper, *appearing in the third metallurgical horizon (Bodrogkeresztur–Trypolje CI) most probably as a result of influences from Asia Minor* (Łęczycki 2004: 66, 68, there further literature). The Caucasian--Anatolian metalworking utilising arsenical copper, and then arsenic bronze, as well as the distribution of the products in Europe is most broadly described by the concept of Evgeni N. Chernykh of the existence of a Circumpontic Metallurgical Province/ Circumpontic Cultural Province, the prologue of which is dated to around 3600 BC (Černych 1977; Chernykh 1992). The issue of the correspondence of "Bytyń metallurgy" with this province needs to be the subject of future research (cf. previous

suggestions on the topogenesis of the copper objects from Gródek; Gumiński 1989: 168). Currently, this assessment seems to be additionally justified by the latest research on Carpathian-Volhynian metallurgical centres (Klochko and Klochko 2013; Klochko 2017). Against this background, it is worth noting the presence of FBC ceramic "imports" with features corresponding to the Pikutkowo style zone (Rybicka 2017: 43–47) in central Transdnistria, in the area of local copper deposits (Klochko *et al.* 2000; 2003; Klochko 2017).

Valuable information on the question of the relationship of the metallurgical centres of the Jevišovice C2/C1 horizon with the FBC is provided by a deposit of copper artefacts from Kałdus in Chełmno district. Among other things, it contains a dagger of Usatowo type (Adamczak *et al.* 2015). The ceramic context of the deposit is identified with the Wiórek-Mątwy pottery style zone and thus associated with the IIIC phase. In the evaluation of this assemblage, M. Rybicka states *that these are artefacts of a possible south-eastern, probably Tripolyean, origin* (Rybicka 2017: 141). An analogy to this find may be a dagger made of arsenical copper from Gaj 1, Włocławek district. This was the only furnishing of the central burial of tomb no. 2 (Papiernik *et al.* 2018: 450 and Fig. 9) dated to 3620–3380 BC (Poz-83418, 4700±50 BP). The next analogy to the copper dagger comes from the old upland area on the upper Vistula, from Słonowice site 5, Kazimierza Wielka district, long barrow VIII, feature 104. It was found in a clear FBC context and is dated indirectly to the period 3625–3350 BC (Przybyła and Tunia 2013: 145–154 and 157).

CONCLUSION

In our opinion, the current state of research outlined above on the taxonomical and autogenetic location of the FBC pottery with frugal decoration should lead to a broader reflection on the strategy of interregional relationships concerning both the diagnostic features of this category of material (along with the standardisation of its recording) as well as analytical procedures. The second of the postulated research fields includes the recognition of forms and generators of application of copper/arsenic copper products in the FBC and their relationship to the concept of the "Pikutkowo style zone", as well as the problem of its relationship to the new "megalithic culture" which was formed at that time in a version of the Globular Amphora culture. Future work should include reflection on the methods of their cultural conceptualisation. We consider this to be one of the main requirements for progress in the understanding of the 4th millennium BC as the era of the Neolithic/Eneolithic breakthrough on the plains of Central and Eastern Europe, in the broad context of its relationship to the circle of "megalithic cultures".

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The State of Current Knowledge of the Eastern European Sub-Neolithic in Poland

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The article contains an assessment of the current state of recognition of the phenomenon present in the Neolithic of Polish lands, and referred to as the Eastern European sub-Neolithic. The picture it represents is does not provide grounds for optimism. The causes of the bad situation are outlined. The paper presents recent achievements and basic gaps in the evidence, among which the most important is the lack of research at potentially homogeneous sites. This make impossible to undertake the discussion of the problem of the local genesis of the phenomenon, the chronology and dynamics of its transformations or broader considerations on the character and the scope of interactions between pottery-producing hunter-gatherers and early agricultural communities. Interwoven into the narratives have become the views of Jan Kowalczyk (1969), in which the sub-Neolithic had an important role in the processes ongoing in the Neolithic period. The purpose of references to texts from half a century ago is not the desire to return to the general concepts of this researcher, but rather to consider the accurate and still valid specific observations of J. Kowalczyk and about the conviction expressed by him that a better understanding of the sub-Neolithic is important for discovering and comprehension of the processes occurring in the Neolithic of Polish territories (understood as a period).

KEY-WORDS: sub-Neolithic, para-Neolithic, Pottery Mesolithic, Neolithic, Poland.

INTRODUCTION

In the Neolithic and at the beginning of the Bronze Age, hunter-gatherer groups lived in the Polish territories alongside agricultural groups. In our research tradition, we used to separate their relics into aceramic – classified as the Mesolithic – and ceramic ones – labeled the sub-Neolithic. In the milieu of Warsaw archaeologists for the latter, the term "para-Neolithic" is more popular, while Jan Kowalczyk (1969: 14)

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introduced the term "Pottery Mesolithic" (used until now). There are also several other names for this phenomenon to be found in the literature (cf. Kukawka 2010). If behind the quoted terms is hidden their similar understanding in terms of content, so all theoretical and linguistic considerations that justify the choice of one of them over another can be treated as barren cognitively. I have used the term "sub-Neolithic" consistently for years; so it is in this text.

The focus of my attention will be on the area of north-eastern Poland (approximately the Vistula's right-bank Mazovia, Podlasia, Warmia, Masuria), where the discussed phenomenon is most fully legible. I will mention other areas only in order to show the importance of the north-eastern Polish sub-Nolithic for understanding the processes taking place in the Neolithic period.

THE RESEARCH IMPLICATIONS OF STUDIES OF THE EASTERN EUROPEAN SUB-NEOLITHIC IN THE TERRITORY OF POLAND

In 1924, Leon Kozłowski assessed the state of research as follows: *The area of north-eastern Poland* [within the pre-World War II borders – SK] *is the least systematically researched and elaborated, although cultural relations in the Neolithic are extremely interesting and important here, for understanding the totality of the Stone Age, not only of Poland, but the whole of north-eastern Europe* (Kozłowski L. 1924: 70).

In turn, Jan Kowalczyk in his assessment of the archaeological evidence linked to the Pit-and-Comb Pottery culture wrote: *Unfortunately, in the Polish territories, the state of research on this culture is the worst* [in comparison to that of other cultures of the Polish Neolithic – SK] *and for over 40 years actually nothing has changed in this situation.* In the footnote to this opinion he says that *The main reason for this is the lack of sites of this culture which have been examined in a systematic way (which also has its reasons) and the lack of material from Mazovia and Podlasia.* A little further on, he says that *we are only in the preliminary phase of research* (Kowalczyk 1969: 29). These findings had an impact on the scope of the inquiries contained in the elaboration referred to. After a few years, Elżbieta Kempisty fulfilled the postulate of the need to study material from Masovia and Podlasia (Kempisty 1972; 1973). Therefore it is worth considering the reasons for the unflattering opinions of J. Kowalczyk about the state of research in his time, as well as to consider, where we are now in this regard.

The state of research on the Neolithic and sub-Neolithic has been influenced by historical factors.

During the period of Partitions of Poland [the 18th and 19th centuries], the territories in which we are interested were located within two separate empires. It was the time of crystallisation of archaeology as a separate scientific discipline. Although numerous artefacts related to the Neolithic were gained at that time, their proper

assessment was still far away. The interwar period, from the perspective of knowledge about the sub-Neolithic, could have given rise to new positive insights into the problem. The eastern borderlands of the Second Polish Republic at that time offered good opportunities for fieldwork. The time, however, was not conducive to the emerging institutional structure of archaeology with the main center in Warsaw and the second centered around the University of Vilnius. It was also difficult to undertake significant cognitive research work in the relatively short time (about 20 years) between World Wars. In the areas most important for understanding the sub-Neolithic phenomena – situated in hostile Soviet Russia – there was also no progress in studying the problem. The situation was slightly different in the Baltic countries. The greatest progress in research took place then in the area of East Prussia, in this milieu many publications were published by German researchers at that time (e.g. Stadie 1921; Gaerte 1927; La Baume and Langenheim 1933; Richthofen 1934; Engel 1935).

The period of World War II, for obvious reasons, did not contribute anything new, and was a great setback regarding the cognitive possibilities. The war losses that particularly affected East Prussia almost completely deprived us of material and documentation. These losses make it impossible to re-analyse the results of pre-war research (cf. Kempisty 1969; Kukawka 1999).

After World War II, the issue of the sub-Neolithic was marginalised in Poland. The pre-war "borderlands" had been included within the borders of the USSR, but part of Eastern Prussia was now within the borders of Poland. Sub-Neolithic issues were somewhat territorially reduced. The "border of friendship", contrary to this denotation, was not conducive to contacts between researchers from Poland and the Soviet Union. This fact, as well as the loss of Prussian collections, limited the possibility of direct contact with archaeological finds, and without this, any serious development of knowledge was hindered. Referring our findings to the wider Eastern European background, one can use almost exclusively the published reports (often rather vague). Although the knowledge of the literature on neighbouring countries is invaluable, the lack of the opportunity to learn about the artefacts and research documentation as well as the limitations of contacts between researchers and lack direct discussions is a severe handicap. Only the last decades have significantly improved the situation.

The historical conditions were not the only reason for a limitation in acquiring knowledge about the ceramic-using hunter-gatherer peoples. Several other factors contributed also to this.

In Polish archaeology, a specific division of researchers took place along chronological lines. From the perspective of the issues discussed here, one should indicate the rather "sharp" border between Neolithic and Mesolithic specialists. This was noted by J. Kowalczyk (1969: 56), pointing to the negative effects of such diversification of competence. Mesolithic researchers, flint specialists, dealt with hunters and gatherers, and (consciously or unconsciously) ousting the phenomena of ceramics from their

interests. In turn, for Neolithic researchers, it was more important to recognise fully-agricultural cultural structures. The main issues addressed by these members of the discipline included the nodal problems of Neolithisation, and thus its beginnings (the Danubian cultures, mainly the Linear Pottery culture) and the formation of the local Neolithic (especially the Funnel Beaker culture). To put it in a simplied way, the sub-Neolithic has become nobody's problem. A similar remark can also be applied to researchers in Western Europe (except Scandinavia).

The mentality of the archaeologists themselves has also a significant impact on the relatively weak state of knowledge of the Polish sub-Neolithic. Researchers of the "full" European Neolithic, also the Polish ones, isolated archaeological cultures based primarily on the diversity of pottery (cf. considerations on archaeological culture in J. Kowalczyk 1969). We are used to the existence of a significant diversity between cultures. From this perspective, the world of the Eastern European sub-Neolithic looks quite uniform, especially due to the simplicity of the form of the vessels. The "West" appeared and appears to be subject in the Neolithic period to dynamic cultural changes, while the "East" looks like something stable and uniform. Even today, one can find Polish archaeologists, less oriented in current knowledge, who are inclined merely to combine all pottery from the "East" with the Comb Pottery or Pit-and-Comb Pottery culture. Of course, in 1969, J. Kowalczyk was not the first who noticed the greater complexity of this problem. This was already perceived by German researchers (in reference to the present Polish territories), in works referred to by him. Archaeologists who were dealing with the areas for which ceramic-using hunter-gatherer groups were the only ones in the Neolithic time also clearly understood it.

The problem of the mentality of archaeologists, regardless of the period they deal with, is also the need, or perhaps the expectation, of spectacular discoveries. Simplifying the matter a bit, it must be remembered that the Polish sub-Neolithic sites occur in two geological environments: in peats or in sands. From the perspective of the interpretive complexity, both are difficult. In the case of peat sites, although geological stratigraphy is legible there, the linking of artefacts with it is ambiguous, for example due to the principles of the action of gravity. In turn, sand sites have the disadvantage that their monolayer character makes it difficult to difersify the heterochronous artefacts (this was noted by various researchers, J. Kowalczyk as well). However, peats give a chance for a greater variety of the explored cultural remains, especially of organic raw materials. So they are desirable if only for this reason, but also extremely difficult to discover. At the same time, the methodology of their research at the stage of excavations and analysis of the results is complicated and expensive. Due to these problems, there are very few studies of peat sites in Poland. In turn, sandy sites, although easier to discover and to research, have their limitations as to the number and quality of artefacts found. Of course, this does not exclusively apply to the Neolithic. A good knowledge of the "sand" sub-Neolithic would require the study of a significant number

of sites. Perhaps then, by tracking the contexts of pottery and other artefacts (especially made of flint) found along with it, it would be possible to isolate potential homogeneous collections. Such a method, it seems, has proved to be excellent in the research of the "sand" Neolithic in the Chełmno Land [Kuyavian-Pomeranian voivodeship]. Examination of dozens of small settlement points in the region with documented surface finds of ceramics of the Funnel Beaker culture has allowed interesting conclusions to be reached. In this region, ceramics with the characteristics of the North-eastern European sub-Neolithic never occur independently, but are always associated with artefacts of the Funnel Beaker culture. In turn, both types of pottery found jointly are not correlating with flint finds that can be assigned to the Late Paleolithic or the Mesolithic. The weakness of these studies was the lack of spectacular discoveries that could excite the archaeological milieu, and their time absorbing character. They took us over twenty years. So it is easy to understand the researchers of the "sand" sub-Neolithic, both old and present ones, that they were rarely willing to become engaged in long-term field research projects. The need for success, especially when it should be fast, can effectively discourage research on rather unattractive sand sites, poor in artefacts.

Finally, one should note one more ailment of archaeologists, namely their feeling of "territoriality". Researchers from particular archaeological centres maintain (consciously or not) the right to research certain territories. Although positive justifications can be found for such attitudes, this is not always conducive to the development of our knowledge. From the perspective of understanding the Eastern European sub-Neolithic in Poland, such a centre was and still is Warsaw, with powerful archaeological institutions (the largest institution of the Polish Academy of Sciences, university units and the archaeological museum) gathering the largest number of archaeologists in Poland. Indeed, the main works devoted to this issue originated thanks to researchers from this centre (Gardawski 1958; Kowalczyk 1969; Kempisty 1972; 1973). Studies made by the authors referred to, coming from the times when they were working at the State Archaeological Museum, disregarded the former East Prussia territories. What is important, their sources bases were limited to ceramics, almost entirely recovered from surface survey. This narrowed the outlook of the research and is reflected in the poor level of credibility of the final conclusions. For Prussian territories, one can indicate the studies of Jerzy Okulicz (1973), but this, having been based on data from literature, in the area of formulating conclusions could not go beyond the findings of German researchers. The article by E. Kempisty from 1983 had a similar character, although also included references to the current findings of scientists from the former Soviet Union.

All of the above-mentioned authors postulated intensification of research on the problems of Eastern European cultural phenomena in Polish territories. Systematic studies of sub-Neolithic sites were undertaken in the 1970s by E. Kempisty with a team

(e.g. Sulgostowska 1978; Kempisty and Więckowska 1983; Kempisty 1988; Kempisty and Sulgostowska 1991). Her untimely death (in 1985) interrupted this research project. Excavations at sites related to the Eastern European sub-Neolithic were also undertaken by other researchers (e.g. Burek 1976; Gumiński and Fiedorczuk 1988; Gumiński 1999; 2011; Manasterski 2009; Wawrusiewicz *et al*. 2017). Some summaries of current knowledge have also appeared (e.g. Józwiak and Domaradzka 2011; Wawrusiewicz 2011). Nevertheless, after half a century from the summary made by J. Kowalczyk, it is still true what he said. He stated that, in the context of knowledge of the Polish Neolithic, the state of research on the sub-Neolithic "presents itself the worst" and we are still "in the preliminary phase of research" (Kowalczyk 1969: 29). This remark concerns not only the study on the sub-Neolithic, but also other phenomena of the Neolithic in the area of north-eastern Poland. For example, I derive my knowledge about the Linear Pottery culture from the summary by Anna Kulczycka-Leciejewiczowa (1979), and that about the Funnel Beaker culture basically from a study by Konrad Jażdżewski (1936). For the sub-Neolithic of these areas, the summaries still applicable are works by E. Kempisty and J. Okulicz, from almost half a century ago. I omit the not very successful synthesis by Tadeusz Wiślański from 1979 (Wiślański 1979a: Kempisty 1981).

THE CURRENT STATE OF KNOWLEDGE UNDERSTANDING OF THE SUB-NEOLITHIC IN NORTHEASTERN POLAND

At this point, attention should be paid to the study of the Eastern European sub-Neolithic outside the zone of its potentially "pure" occurrence. I would point here to two trends in study on the issue. On the one hand, it is represented by the monographic study by Bartosz Józwiak regarding the sub-Neolithic in the region between the Vistula and the Odra rivers (Józwiak 2003), and on the other publications resulting from research on the Funnel Beaker culture in the Chełmno Land (Kukawka 1991; 2010; 2011).

In the first case, material close to that from Mazovia have been analysed. The main point of reference was the results of research by E. Kempisty (from thirty years ago: Kempisty 1973) and current knowledge developed by Belarusian researchers. The poor state of research in Mazovia had an impact on interpretative limitations, such as the chronology of events or the interactions between the "two worlds" – that of hunter-gatherers and of farmers-stockherders.

The situation of the Chełmno Land is more complex. We are dealing here with the material evidence of the relationship of these "two worlds" (massively occurring elements of the north-eastern sub-Neolithic at the sites of the Funnel Beaker culture). The losses of material from the former East Prussia adjacent to the Chełmno Land in the Second World War and the marginal interest of Polish and Russian archaeologists

in this area after the War significantly hinder the proper understanding of these interactions, which would have occurred in the direct contact zone of farmers with ceramic-using hunter-gatherers. Meanwhile, archaeological identifications of the latter (from the Narva and possibly the Comb culture's circle) in the area of East Prussia are extremely modest. Findings from the Chełmno Land related to the sub-Neolithic, also undermined the generally accepted view of the essentially unilateral impact of farmers on hunter-gatherers. They revealed the scale of reverse influences, a concept which – at least initially – did not meet with universal acceptance (e.g. Kośko 1988: 109–114). Besides pottery, the existence of relations between the Funnel Beaker culture with the northeastern sub-Neolithic is evidenced also by the occurrence of characteristic projectile points made from flint (Małecka-Kukawka and Kukawka 1984; Kukawka 2010: Fig. 11)

The critical assessment of the knowledge of the sub-Neolithic of north-eastern Poland presented above does not mean that during the last half-century, nothing has changed in our knowledge about it. But although there have been new discoveries and studies on material from this area, a lot of the changes that have taken place in our perception of the dynamics of the transformations of "ceramic" hunter-gatherers, the progress of research in neighbouring areas has been of greater importance.

We know increasingly more about the sub-Neolithic sites in the areas of Belarus, Ukraine, Lithuania, Latvia, Estonia and Russia. Here the success in differentiating and ordering of the ceramic material is significantly better than before, which is reflected in the distinguished taxonomic (cultural) units. Although these divisions are still not fully satisfactory, they allow the better differentation of related ceramics from Polish territory: Pripyat-Niemen culture, Volhynian, Niemen culture, circle of the Narva and the Combed ceramic culture, Zedmar culture, North Belarussian culture and surely also others.

The area of north-eastern Poland is a transition zone of the permeation of settlement and interactions between the sub-Neolithic population groups and the world of the farming-breeding Neolithic peoples: of the Danubian cultures, the Funnel Beaker culture, the Globular Amphora culture, the Corded Ware culture or the cultures of the Early Bronze Age. Progress in the diagnosis of the latter is significant, although this refers to the discussed areas only to a small extent. This allows a proper classification of artefacts associated with them, occurring on sites of this zone, alone or in sub-Neolithic contexts. It also enables investigation aimed at identifying their impacts, which are readable in sub-Neolithic ceramics. A better understanding of the chronology of cultural phenomena of the Neolithic and the beginning of the Bronze Age is supported by the establishment of a chronological framework for finds, which, given the scarcity of radiocarbon dates for north-eastern Poland, is extremely valuable. In addition, we can increasingly better identify ceramics with sub-Neolithic features in Neolithic and Early Bronze contexts. This also brings us closer to a better

understanding of the interactions between the "two worlds". They were bilateral, which means that if we want to talk about the "Neolithisation" of hunter-gatherers, then at the same time, we must recognize reciprocity, that is, the "sub-Neolithisation" of farming and breeding communities. Therefore, the possibility should be allowed that we should consider our sharp archaeological divisions of the economics of former communities into the two mentioned "worlds" – of hunter-gatherers and farmers-stock herders – as not so significant. In the wide zone of the borderland, for groups entering into mutual relations, the fact that different methods of gaining food were practiced was not so important. At the same time, from the perspective of the sub-Neolithic groups, by no means was their aim to adopt the "cultural achievements" of their neighbours (which for us, archaeologists, are land cultivation and animal breeding), considering that intensive contacts lasted about 2000 years and at that time we do not find any evidence of economic transformations in the hunter-gatherer societies. Unfortunately, information on this subject is very poor and generally limited to the analysis of the ecological niches settled by various groups, or supported by findings from neighbouring countries, though only exceptionally in a more unambiguous manner.

Intensification of the discussed interactions came about during the Funnel Beaker culture (not later than about 4000 years BC – Kukawka 2010; 2011), which some researchers have already noted (e.g. Jażdżewski 1932; Gardawski 1958; Kempisty 1973). In later times, in this zone appeared unequivocal traces of the settlements of the Globular Amphora culture, the circle of the Corded Ware culture, the Bell Beaker culture or the Iwno culture. It is widely believed that the disappearance of ceramic-using hunter-gatherer groups in north-eastern Poland occurred together with the emergence of the Trzciniec culture (Gardawski 1958; Kempisty 1973; Józwiak 2003). All these units left their mark on the culture of the sub-Neolithic groups (hence the aforementioned 2000 years of mutual relations). However, it should be remembered that these relationships are readable almost exclusively in the context of the ceramic evidence, which, due to the inability to establish their homogeneity, is not always unambiguous (e.g. the latest unpublished work by Sylwia Domaradzka from 2014).

It cannot be ruled out that these interactions had a slightly earlier chronology than the one presented above. I will point here to the views on the genesis of the Zedmar culture (Timofeev 1998; Gumiński 1999). They are fostered, among others, by the discovery of material of the Late Linear Pottery culture at Równina Dolna (Rybicka and Wysocki 2003) or the findings on the chronology of the Zedmar culture (Kozicka 2017). One can also indicate the potential early inspirations of ceramic ornamentation in the eastern sub-Neolithic (single pottery fragments from the Brześć-Kujawski group/culture).

Unfortunately, we are still unable to solve many important problems. We do not know the chronology of the beginnings of the sub-Neolithic in north-eastern Poland. From the perspective of research in neighbouring countries, they could reach back

even to the time of the Linear Pottery culture. About materials occurring in Masovia and Podlasia that refer to the Pripyat-Niemen culture (previously the Dubičaj phase of the Niemen culture) one can say that they may be older than the Funnel Beaker culture (i.e. than 4200/4100 BC). Other material that may also be older than the Funnel Beaker culture could be finds of sub-Neolithic pottery from Dzikowo, located in the Dobrzyń Land [Kuyavian-Pomeranian voivodeship] (Kukawka 2010) or from Barkweda in the Olsztyn Lake District (Józwiak and Domaradzka 2011). Both sites have radiocarbon dates (for ceramics and carbon deposits on ceramics). In the first case, however, there is a significant standard error, in the second – a difficult to explain contradiction with the findings of researchers from the Baltic countries regarding the chronology of decoration of the typical Comb ceramic. The hypothesis of the emergence of the sub-Neolithic in the north before the beginnings of the Funnel Beaker culture results mainly from theoretical premises and the approximately determined beginnings of the Zedmar culture.

We have practically no knowledge about the genesis of the sub-Neolithic in our territories. This is about an impossibility of verifying one of the two models: the acculturative (sub-Neolithisation/"ceramisation" of local Mesolithic communities) or the migrational one (migration of sub-Neolithic peoples from the east or north-east). This results both from the scarcity (lack?) of homogeneous collections of artefacts, as well as from the difficulty in investigating the process of its genesis (the lack of reliable information on the contexts of flint artefacts). It is possible that this is a deeper problem, related to the impossibility of archaeology in determining the origins of phenomena classified on the basis only of ceramic evidence. Although we have become acquinted in part with the characteristics of the ceramics from individual sites, we are still not able to create satisfactory systematisation of potentially homogeneous collections. Therefore, it is impossible to understand the dynamics and chronology of the transformation of manufacturing of ceramics, and as a consequence of this, other categories of artefacts, the forms of settlement, the settlement of individual ecological niches, etc. Without such knowledge it is impossible to undertake any study of cultural-genetic problems.

This thread inevitably leads to the analysis of the Neolithic – sub-Neolithic interactions at all cultural and chronological levels. Although these relations can be perceived as "Neolithic pressure to the east", the lack of signs of the "progress of civilisation" (the economic one) in this sub-Neolithic period makes the problem more complex. We do not know, therefore, what these mutual relationships consisted of and to what extent they modified both sides. These problems are not easy for archaeology to study, and in the current state of knowledge of the Polish sub-Neolithic impossible to undertake, except at the level of the identification of the material evidence.

The key to the resolution of the issues referred to here, if can be resolved at all, lies in archaeology of north-eastern Poland and with researchers of the Later Stone Age

– the Neolithic understood as a period. In my opinion, formulated hypotheses must be examined archaeologically. This, in turn, requires a better knowledge of the Neolithic phenomena in the area in question, and this is – to put it mildly – highly unsatisfactory. It is worth recalling here, among other archaeological surprises from recent years, the discovery of the site of the Late Linear Pottery culture in Równina Dolna (Rybicka and Wysocki 2003), "assemblages of Ząbie-Szestno type" (Manasterski 2009) or materials of the Waldburg type (Zalcman 2010). We should expect in future years many more such surprises.

JAN KOWALCZYK'S "CERAMIC MESOLITHIC" – A FEW REMARKS AFTER HALF A CENTURY

The unquestionable merit of J. Kowalczyk was his perception of the phenomenon of the presence of ceramic-using hunter-gatherers as essential one for understanding the Neolithic. In his work from 1969, besides the Linear Pottery culture, Funnel Beaker and Globular Amphora cultures, he presented the Pit-and-Comb Pottery culture, accentuating its importance in the Neolithisation process. This resulted from his processual vision of the beginnings of the Neolithic period in the territory of Poland. In a broader sense, this is the issue of the participation of hunter-gatherers in the Neolithisation process. Although researchers have willingly indicated their significant role, e.g. in the genesis of the Funnel Beaker culture (e.g. Wiślański 1979b; Kośko 1981; Nowak 2009), a lack of significant progress in research on this problem is still visible, and the effects of such research are far from being satisfactory. Such views therefore still remain more in the sphere of intuition than well founded argumentation.

The problem of the sub-Neolithic can be described in a similar way. J. Kowalczyk (1969) was aware of the complexity of taxonomic, genetic and chronological problems related to artefacts associated with the "Pit-and-Comb Pottery" cultures. It is easy to find the reasons for the neglect of his views in later works. It may be noted that the lack of confirmation or incorrect character of some of his ideas became clear. It cannot be forgotten that four years later, his deliberations were supplemented by a study by E. Kempisty (1973) devoted to this phenomenon (though almost exclusively to aspects of the cultural and chronological ordering of the ceramic artefacts). For some researchers it was unacceptable that J. Kowalczyk situated as equivalents peoples that were, in the belief of some of the archaeologists, very different from each other in terms of their development – "savage" alongside "civilised" ones.

J. Kowalczyk did not treat the Pit-and-Comb culture as a monolith. It was not even an archaeological culture for him. This concept was rather a "general-interpretation" in the sense of a "cultural cycle". This view found full confirmation in later years. Already before, researchers noted the connections of the "Polish" sub-

Neolithic with various Neolithic phenomena, starting with the Funnel Beaker culture, and ending with the Trzciniec culture (e.g. Jażdżewski 1932, Gardawski 1958). This was also unambiguously confirmed by E. Kempisty (1973). This view, however, was treated by archaeologists quite one-sidedly, which resulted from the evolutionist approach, suggesting that the "more developed" culture (here: Neolithic) positively influenced the "more primitive" (here: Mesolithic or sub-Neolithic) one. These were hunter--gatherers who had to undergo the acculturation processes, to eventually, even as late as at the beginning of the Bronze Age, shift to the higher economic level of development. That's how the problem was understood by J. Kowalczyk. In his general model of the beginnings of the Polish Neolithic, the new economy played a leading role. The second element was the knowledge of pottery vessels, which until recently had still been regarded as an invention of the farming and breeding communities. It was supposed to exemplify the dissemination of land cultivation, including in particular greater stability of settlement in relation to hunter-gatherer groups (from the perspective of the Polish lands – Mesolithic societies), which was also confirmed by other data (e.g. traces of houses traces of houses and pits, numbers of artefacts, size of sites etc.), or finally logical reasoning, according to which the complexity of agriculture forced durability of settlement. The third element was people – a population substrate of the beginnings of the new economy in Polish lands. They could be migrants or the indigenous population of the Mesolithic. Questions about the fate of the latter bothered archaeologists for a long time and still occupy them at present. J. Kowalczyk assumed that it was the Mesolithic population that was the population and cultural substrate of the local Neolithic, and possible migrations were of marginal importance, although they played a culture-forming role, acting as "donors" of new cultural achievements. He distinguished several territorial and chronological stages of the spread of knowledge of agriculture. *Knowledge of agriculture, as the first wave of influences from the south-east, was originally very seriously ahead of the production of ceramics. The further it penetrated to the north, the more its extent decreased. In some areas, the knowledge of agriculture was probably contemporary with ceramics, and further in the forest zone, it was even accepted as a later influence* (Kowalczyk 1969: 47). It is not my goal to discuss this model more widely. Here, it will only be important to say that the sub-Neolihic ("ceramic Mesolithic") has been treated as a stage limited to a certain territory where the knowledge of pottery arrived ahead of the adoption of new economic models.

Jan Kowalczyk treated his model as a proposal. He took into account the existing concepts, and recognized gaps and contradictions in them. In many places he emphasised the deficiencies or shortcomings of credible material evidence as foundations for interpretations. He presented his own theoretical model, postulating testing it by gaining new information and indicating critical research problems, the solution of which would allow the verification of individual elements of the model. This was also

true for the sub-Neolithic ("ceramic Mesolithic"), where he clearly noticed the fragile nature of the available empirical data.

Although many of the research hypotheses of this researcher have not survived the test of time, his theoretical considerations on many problems, essential for our discipline, still remain valid. It is regrettable that after fifty years, with a large number of new publications that have appeared in that time and with the narrowing/specialisation of our individual knowledge, we too often overlook the problems of archaeology that were raised by him, forgetting their existence and – often – their primary importance. This is even the case when it concerns the question of the homogeneity of assemblages of finds, the understanding of the so-called archaeological culture and, generally speaking, the theoretical, methodological and methodical basis of our discipline, at all stages of its practising. Too often we forget our implication in our own views and superstitions about the past, too often we unjustifiably objectify our knowledge-building about the past. J. Kowalczyk understood and revealed the cognitive implications of archaeology. It is a pity, therefore, that the lack of confirmation and, consequently, the rejection of his detailed views (even about the Aceramic Neolithic or the sequence of Funnel Beaker culture phases) had the effect that the work *Początki neolitu na ziemiach polskich* [*The Origins of the Neolithic Age on Polish Territories*] fell into oblivion. Today, we consider this work, and other publications of this researcher, almost exclusively from the perspective of the history of the discipline. This state of affairs is also due to the lack of acceptance of J. Kowalczyk's views by his contemporaries among the Neolithic researchers, reflected in the published texts (e.g. Kempisty and Gurba 1971, Kozłowski J. K. 1971). Criticism of his detailed views omitted the assessment of the theoretical layer underlying them. For example, Janusz K. Kozłowski assessed this in just one sentence in the summary of his review: *However, I must say with pleasure that a series of theoretical considerations contained in this thesis made me think about many problems, which will undoubtedly be reflected in further analytical formalisations of the complex problems of the beginnings* of the *Neolithic* (Kozłowski J. K. 1971: 49). Elsewhere in this review we will find a second opinion: *We have to say clearly that the problems of the beginnings of the Neolithic will not be solved in the study room exclusively among books. This issue can, in my opinion, be solved only on the basis of a thorough analysis of materials using all available methods, and above all with the most accessible typological method* (Kozłowski J. K. 1971: 44–45). I believe that these sentences expressed the views of the majority of researchers of that time.

The shape of interpretative models is conditioned by **our convictions** about the cultural past, about the current knowledge, the meaningfulness of questions asked and on how to answer them, about the understanding of archaeological sources (e.g. the issue of the creation of the archaeological evidence, essentials of their analysis, argumentative power, etc.). In this approach, the application of the source-creative typological method postulated by J. K. Kozłowski has two dimensions: as an

inspiration and the its application to the verification of posed hypotheses. This happens regardless of our awareness or acceptance. In the context of Polish archaeology, Jan Kowalczyk, aware of the entanglement of prehistory in such issues, was a pioneer of a new narrative of the Neolithic, unappreciated not only by his contemporaries, but also by many of today's archaeologists.

The work *Początki neolitu na ziemiach polskich* [*The Origins of the Neolithic Age on Polish Territories*] was published half a century ago. Since then, our knowledge of the Neolithic has grown enormously. This applies to both the source data and interpretation concepts. From such a perspective, J. Kowalczyk's work might be seen to belong to the "prehistory" of archaeology, especially since we will not find any modern analyses of the material culture there. From the point of view of the theoretical layer, the situation is different. In this respect, reading the work of J. Kowalczyk can still provide many reflections and inspirations.

In summary, one should recall the apt opinion of L. Kozłowski that better knowledge of the Neolithic of north-eastern Poland is important for understanding the totality of the Stone Age, not only in Poland, but also in the whole of North-Eastern Europe (Kozłowski L. 1924: 70). The idea of J. Kowalczyk (1969) on the entanglement of the hunter-gatherer and early-agricultural communities in the cultural processes taking place in these areas should also be accepted. Without a significantly better archaeological understanding of phenomena occurring in the areas of interpenetration of these "two worlds", we will not understand the relations between them. They played a significant role in history, too often seen unilaterally as Neolithisation of the "savage", and too seldom – as also the sub-Neolithisation of the "civilised". Today we know that they were two-sided processes that lasted for a very long time. Without better understanding of the archaeology of this period in north-eastern Poland, we would not be able to understand the Neolithic of Polish lands in general. We can also contribute a lot to the archaeological knowledge of the past of our eastern neighbours.

Translated by Andrzej Leligdowicz

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The Funnel Beaker Culture in Western Lesser Poland: Yesterday and Today

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Although Jan Kowalczyk's work on the Funnel Beaker culture (TRB) did not particularly refer to western Lesser Poland, many of his general and detailed reflections on Neolithic archaeology can be utilized to better characterise this culture in this territory. The TRB appeared there c. 3750/3700 BC and existed until *c*. 2800 BC. "Funnel Beaker" acculturation of the late Lengyel-Polgár populations could play a large part in the origins of the local branch of this culture. For many years, the TRB seemed to be scarcely represented. This notion has changed since early 1970s onwards, due to more and more intensive investigations. Currently, western Lesser Poland is perceived as an equally important region of the TRB development as other the most important ones both in Lowland and Upland zones. The local TRB communities were characterised by varied patterns of settlement and economic behaviours. These patterns were correlated with ecological differences.

KEY-WORDS: Funnel Beaker culture; western Lesser Poland; absolute chronology; Jan Kowalczyk.

I never had the opportunity to meet Jan Kowalczyk in person. This was due to generational disparities as well as due to us belonging to slightly different research schools. I encountered his name, of course, during my studies, when my archaeological specialization began to crystallize. It quickly became clear to me that he was an extraordinary figure that left a significant mark on Polish archaeology.

If we want to recollect Jan Kowalczyk, we should not only give him a good write-up. I believe that at present his achievements should be a call for us to reflect on the state of today's science (not only archaeology and prehistory) and ways it is practiced.

Kowalczyk's scholarly achievements reflect a situation completely unrelated to the current realities of scientific life. These realities are primarily a requirement to publish, publish and publish as much and as quickly as possible; and to publish only in such journals/books which provide a lot of "points" (*publish or perish* rule). Such an attitude is convenient for officials and politicians who manage science, and for evaluators and

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experts of various types. What is the value of all this? Of course, very variable, because the quantity does not always turns into quality.

What is more, is anyone able to read these oceans of journals, books, pdfs, and so on? Are those who produce countless publications interested at all in science as such, i.e. in "discovering the truth", as it is pathetically but accurately described. The answer to both questions is obviously "no", but this is of concern to a few it seems. Officials are satisfied, as are those scholars that succumb to "pointosis", those who are still resisting become depressed and demotivated. And so it goes on.

Jan Kowalczyk and his works demonstrate that scholarship is something else. The point is that our printed publications should bring us closer to this "truth", and not become – after obtaining the appropriate number of points – merely scrap paper for recycling. The point is that each publication should be deeply thought out, discussed, carefully and clearly formulated (which does not mean that publications are to avoid far-reaching or even risky interpretations and hypotheses). The publications by Jan Kowalczyk were precisely of this kind. The fact that there were so few of them is of lesser importance. Each of them was a kind of a diamond that shines up to this day. Despite the fact that, for obvious reasons, they have lost their relevance, they have not been forgotten. The best proof of that is the current volume.

Jan Kowalczyk was mainly engaged in the study of the problems of the Neolithic period. Among other things, he dealt with the processes of Neolithisation, both the first and the second. His particular interest was the Funnel Beaker culture (TRB). But let us also remember that he also praised the importance of the theoretical considerations in archaeology, in times when hardly anyone took up such topics. The article from volume no. 29 of *Wiadomości Archeologiczne* (Kowalczyk 1963) stands in fact ahead of many "western" reflections of this type. Among other things, he proposes there the thesis that terminology, created in the early phase of science development, does not match realities; with increasing knowledge it even has a detrimental effect on further progress. Discussing the relationship between "archaeology" and "prehistory", he came to the conclusion – which should be dedicated to many contemporary researchers – that we cannot focus only on material artefacts. It is also necessary to study human (pre)history, and events related to it, also in the most remote epochs. For this reason, in place of the term "culture", he proposes the term "people" (e.g. "People of the funnel beakers"). Such an approach would actually mean that archaeological cultures, if diagnosed well, reflect real prehistoric entities (Kowalczyk 1963: 3). Finally, referring to the material evidence, he calls for the full use of its cognitive potential, through the use of "auxiliary sciences", but above all by taking into account all probable interpretations and their premises.

Similarly, the statements, contained in the 1969 publication, on archaeological culture and its derivatives as well as the nature of archaeological evidence (Kowalczyk 1969: 6–9) are highly innovative, not only in the Polish context. The same can be said

about attempts to define notions, such as: style, cultural group, culture, cycle, and belief community included in this publication (Kowalczyk 1969: 8–9) not to mention thoughts on the genesis of archaeological cultures (Kowalczyk 1969: 10).

Finally, in the same publication, he enters even the essence of the humanities (and even a section of the theory of cognition related to these sciences), of course, addressing his ideas mainly towards archaeology and prehistory. Namely, he draws attention to the presuppositional character of investigation activities and the far-reaching relativity of results and interpretations, which is most often forgotten during routine research (Kowalczyk 1969: 3, 14). These thoughts and postulates, which demonstrate how we should approach scientific research, in Polish conditions (but of course not only), were slightly revolutionary in the late 1960s and early 1970s, and they remain so largely to this day. In other words, the postulates that derive from them remain today far from being fulfilled. It is unfortunate that little has resulted from all of the theorizing of Jan Kowalczyk, both in the domestic and international context. Certainly, one of the reasons that prevented wider knowledge of this work was the language. The other was the "iron curtain", but probably the lack of much interest from the potential audience played a big part in it. Nevertheless the challenge was thrown out.

Another thing that we can learn from Jan Kowalczyk, which I have already mentioned, and which partly results from the ideas already pointed out, is the ability to formulate bold and risky hypotheses that are logical and acceptable in the light of the current state of knowledge, although difficult to document. Such a skill must undoubtedly be combined with a considerable dose of scientific and personal courage (they can attract criticism, even sharp and unpleasant – cf. e.g. Kozłowski 1971) and in response require a talent for accurate retorts (see e.g. Kowalczyk 1971). Despite the fact that such hypotheses turn out to be often inaccurate, they become an inspiration to investigations, search and reflections, which ultimately lead to a better understanding of a given part of prehistory.

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The topic of this text is the TRB in the western part of the historical region of Lesser Poland (Małopolska; Figs 1, 2). This territory comprises loess uplands and foothills situated north and south of the upper Vistula River respectively. The valley of the upper Vistula River itself is also a part of this territory, not to mention part of the Western Carpathians.

Jan Kowalczyk did not pay much attention to this territory in his studies on the TRB, but all the above mentioned reflections and postulates also refer, of course, to this place and time. As far as more detailed issues are concerned, it is undoubtedly worth noting that he strongly emphasized the specific status of the TRB (Kowalczyk

Fig. 1. Territory of western Lesser Poland and neighbouring areas (based on Nowak 2014: fig. 1, with modifications); 1 – borders of the area discussed in the paper, 2 – borders of the basic ecological zones: I – "loess" upland (the most fertile zone), II – "jurassic" zone (part of the Cracow-Częstochowa Upland, with flint outcrops, in southern part covered with „loess" soils), III – zone of alluvial plains and basins, IV – belt of Carpathian foothills (in the region south and south-east of Cracow covered by "loess" soils and containing salt water springs), V – the Carpathian Mountains proper; Archaeological sites mentioned in the text and figures: Br – Bronocice, Ka – Kamiennik, Kr – Karniów, Ko – Kolosy, KPC – Kraków-Prądnik Czerwony, Le – Lelowice, Ma– Malżyce, Mi – Miechów, Mo – Mozgawa, Ni – Niedźwiedź, Pn – Prandocin, Pr – Proszowice, Sł – Słonowice, Sm – Smroków, St – Stradów, Sz – Szarbia, Za – Zagórze, Zs – Zastów, Zw – Zawarża.

1969; 1970), which in fact was also an early precedent of later (and indeed current) views. Namely, for the most part the TRB is a reflection of a pottery style, i.e. pottery is the basic, or perhaps the only element determining and unifying "the style of Funnel Beakers" (Kowalczyk 1969: 35). Such an approach is still acceptable these days. It also has its consequences for considerations on other aspects of the TRB, e.g. its genesis. If the TRB is essentially a ceramic style, then it is justified to consider its genesis in

Fig. 2. Territory of western Lesser Poland and the main archaeological units in the late 5th, 4th and early 3rd millennia BC (based on Nowak 2014: fig. 2, with modifications); 1 – borders of the area discussed in the paper, 2 – sites of the Lublin-Volhynian culture, 3 – the Wyciąże-Złotniki group, 4 – the Funnel Beaker culture (a – dense settlement typical of "loess" upland, b – more dispersed settlement typical of foothill, alluvial plains/basins and "jurassic" zones, c – highly dispersed settlement typical mainly of mountainous zone), 5 – the Baden culture, 6 – the Beaker/Baden assemblages.

two ways: generally and regionally/locally. Such approaches can be found in current literature (e.g. Czerniak 2018).

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Since the publications by L. Kozłowski in the 1920s, sites and materials of the TRB in this area have been included into a territorial unit separated from the Lowland groupings of this culture, be it the Lesser Poland culture (Kozłowski 1924), the

Southern Group (Jażdżewski 1936; Kostrzewski *et al*. 1965), or the South-Eastern Group (Wiślański 1979; Kadrow 2018). Jan Kowalczyk in his text in *The Neolithic in Poland* (1970) applies the territorial division into four groups (*modo* Jażdżewski), including the Southern Group, but emphasizes that it is insufficient and we should operate with smaller units (Kowalczyk 1970: 163–164).

Traditionally, for many years, knowledge on the TRB in western Lesser Poland has been quite modest, especially in the interpretative sphere, despite the fact that some of the earliest TRB findings in Lesser Poland (e.g. Wawrzeniecki 1898; 1900; cf. also Cabalska 1960: 159, 218; Rook 1980) came from this area (Fig. 3). This was not changed by numerous excavations in the 1950s and 1960s, to name just Miechów (Mycielska, Wałowy 1964), Prandocin (Radwański 1957), Lelowice (Burchard 1964; 1966), Niedźwiedź (Burchard 1968), Zawarża (e.g. Kulczycka 1961; Kulczycka-Leciejewiczowa 1965), or Stradów (Gromnicki 1961). The large-scale rescue investigations in Kraków-Nowa Huta also led to the discovery of a considerable amount of TRB material, although in comparison with other Neolithic cultures it was a less significant amount (cf. Godłowska 1976). As a result of the lack of comprehensive publications of these field investigations, western Lesser Poland was treated as an area rather bypassed by the TRB communities, due to, among other things, intensive and long-lasting Lengyel-Polgár settlement.

This situation has changed since the late 1960s and early 1970s, when the results of systematic surface surveys on "western loess uplands" were published (Kruk 1969; 1970; Rydzewski 1972; 1973; cf. also Liguzińska-Kruk 1981; Burchard 1997). Among other things, these activities were crowned by a groundbreaking monograph on Neolithic settlement in this region by J. Kruk (1973). These activities provided a huge load of data on the culture in question. It can be said without great exaggeration that, from the TRB perspective, the north-eastern part of western Lesser Poland has now become the area best studied and distinguished in quantitative terms in a nationwide scale. This was fully confirmed by later research conducted within the AZP (*Archeologiczne Zdjęcie Polski* – "Archaeological Record of Poland") project (see e.g. Nowak 2001). The intensive, large-scale, interdisciplinary excavations at the large TRB site of Bronocice (Hensel and Milisauskas 1985: 52–77) in the 1970s was also of unprecedented significance for the topic under consideration. The results, so far published (e.g., Kruk and Milisauskas 2018; Kruk *et al*. 2018; see further references in both monographs), provided fundamental data on the settlement, economic and material patterns of the TRB community that lived in loess upland landscape. Not to be overlooked are the equally fundamental determinants of absolute and relative chronology, the importance of which goes far beyond the site at Bronocice and sites of the TRB in its immediate vicinity. In fact, the Bronocice chronological scheme has become a kind of model of the general developmental pattern of the TRB in the whole upper Vistula River basin.

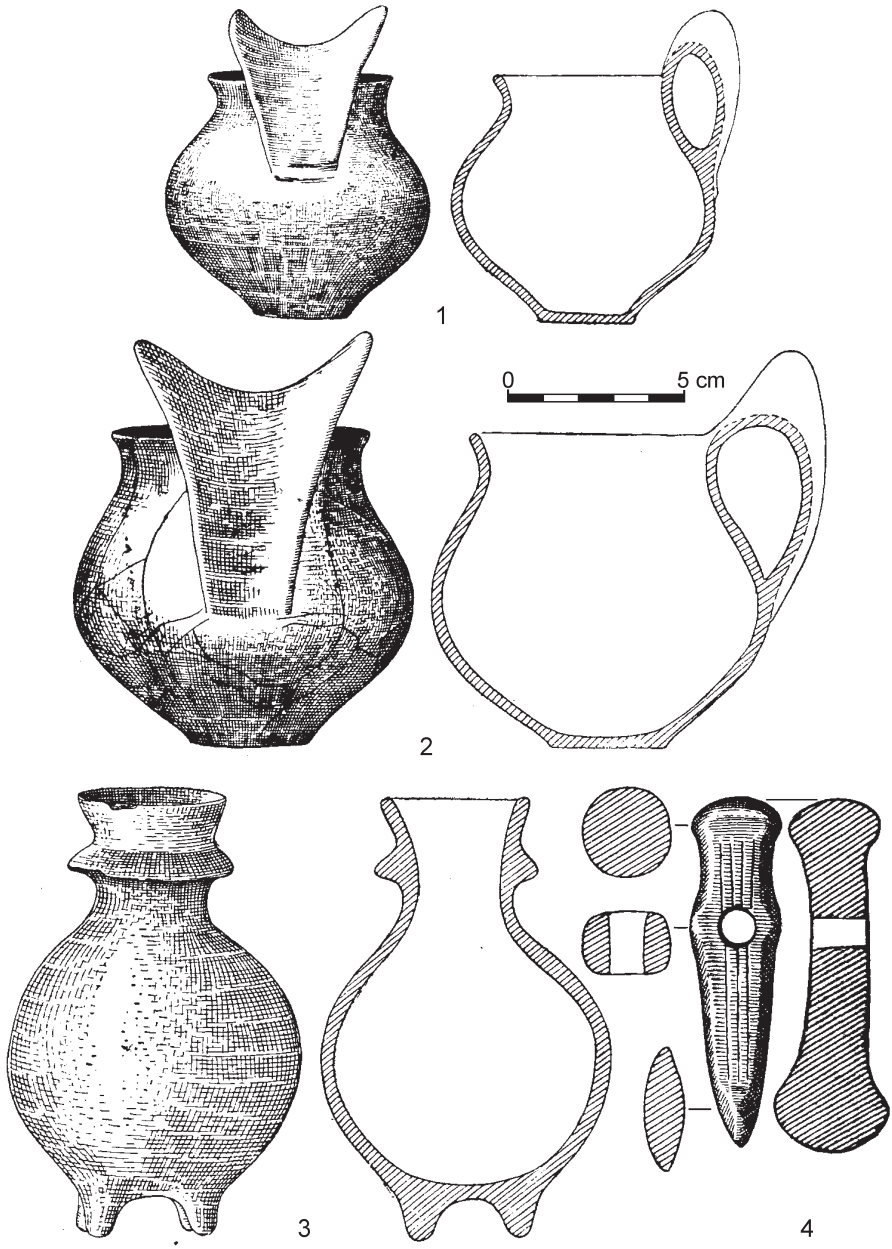

Fig. 3. Selected pottery of the Funnel Beaker culture: 1 – Karniów, single ansa lunata cup found in 1858, 2–4 – Zastów, ansa lunata cup (2), collared flask (3), button-butted axe (4), possibly from a grave, found in 1885 (after Cabalska 1960).

In the last two decades of the 20th century, in addition to the continuation of the AZP action, several other research projects are adding to our understanding of the western Lesser Poland TRB. Of particular importance were excavations of the sepulchral complex in Słonowice (in practice, continued until now – see Tunia 1990; 2006; Przybyła and Tunia 2013) and research on the Neolithic in the Carpathian zone. The monograph by P. Valde-Nowak (1988) can be considered the culmination of the initial stage of the latter studies. It made possible the identification of a number of finds of the TRB, mainly single ones, also in the Western Lesser Poland part of this zone, which clearly shifted the range of this culture towards the south. Equally important is the monograph by E. Rook (1980) on the Neolithic settlement in the caves of the Cracow-Częstochowa Upland, which has systematized our information on the local TRB.

Since the end of the 20th century, a major role in providing new archaeological data in Poland has been taken over by the rescue investigations carried out in connection with large road investments. It is no different in western Lesser Poland. Particularly important here were the excavations on the A4 motorway route, the results of which are being systematically published by the Cracow Team for Motorway Research, although unfortunately much still remains to be done. As far as the TRB is concerned, these studies have perhaps produced less spectacular results, especially in comparison with the "southern" Neolithic cultures, but the volume of new data is substantial (e.g. Zastawny *et al.* 2011; Zastawny 2014; Nowak and Rodak 2015). In the last few years, there have also been conducted rescue investigations to the north of Cracow (including the northern beltway of the city and the S7 road). The first reports, so far oral, indicate relatively abundant findings of the TRB, perhaps even quantitatively ahead of those from the A4 motorway. Finally, it is also worth mentioning the purely scientific excavation of another large TRB settlement in Mozgawa, which was carried out in 2014–2016 (see Nowak 2017; Nowak *et al.* 2017; Korczyńska *et al.* 2019). The results are not yet published and the work here will be continued.

Discussing the research achievements of recent years, it is undoubtedly worth noting the somewhat unexpected absolute datings, indicating the ties with the TRB of at least a few kurgan graves (Kolosy, Malżyce – Włodarczak 2008a; Jarosz *et al.* 2009; Tunia and Włodarczak 2011; Jarosz *et al.* 2013), which originally seemed to belong to the Corded Ware culture. This broadens the already considerable spectrum of sepulchral behaviors of the Western Lesser Poland communities of the TRB.

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Currently it is very well known that western Lesser Poland treated globally is a very important centre of the TRB. Its sites are so numerous that it would be difficult to

count them at the moment. Their number is clearly higher than the number of sites of the "Danubian" Neolithic. This is demonstrated, for instance, by data from the Bronocice micro-region, where the number of the TRB sites is at least three times higher (Milisauskas and Kruk 1984; 1989; Kruk *et al*. 1996: 28–32). The literal interpolation of the available data from this micro-region, referring to the zone of loess uplands north of the Vistula River only, suggests that the number of sites in this zone should exceed 1000.

The communities who left material relics referred to as the TRB were characterised by varied patterns of settlement and economic behaviours (Fig. 2). The "first" pattern is represented by "dense" settlement in the loess upland of western Lesser Poland. The TRB sites are much more evenly distributed than those attributed to the Linear Band Pottery culture (LBK) and the Lengyel-Polgár complex (Kruk *et al*. 1996: 26–33). This also means that large number of the TRB sites appear in zones previously avoided by "Danubian" groups, mainly on the margins of river valleys and in upland watershed areas (Kruk 1980: 108–118). In brief, one can notice a tendency to fill the landscape. The discussed zone is distinguished by the highest formal differentiation of the Funnel Beaker sites, which can be divided into camps, small, medium-size and large settlements (Kruk and Milisauskas 1999). Finally, there are sepulchral sites, including both flat cemeteries and monumental complexes. According to Kruk and Milisauskas (1999; cf. also Milisauskas and Kruk 1984; 1989) around the mid-4th century, micro-regional settlement complexes clustered around large, central settlements.

It seems that TRB people living in this zone practised what may be described as shifting slash-and-burn farming. This locally led to the considerable deforestation of the landscape. The process became more intensive after the mid-4th millennium BC, which produced even larger areas devoid of forest (Kruk *et al*. 1996: 69; Michno 2004: 58–69; Szwarczewski 2009; Poręba *et al*. 2012; Moskal-del Hoyo *et al*. 2018). However, it is impossible to determine whether all of the discussed area was covered by grass or parkland formations at the end of the 4th millennium BC and in the early 3rd millennium BC. One way or another, the TRB communities exploited a much greater part of the available landscape than the preceding groups of the LBK and Lengyel-Polgár people.

The "second" pattern of the TRB settlement is characteristic of the Carpathian foothills, northern fringes of the mountains proper and the eastern part of the zone of alluvial plains and basins (Nowak 2014). The settlement is clearly more scattered here. The archaeological record within sites is manifested by isolated finds or small concentrations of artefacts and features, which provisionally can be classified as either small settlements or camps, and only rarely as medium-size settlements. In this context, one should also mention the finds from the southern part of the Cracow-Częstochowa Upland, which may be the remains of a system of flint resource exploitation. Subsistence was based on farming and animal breeding, although they were realised in

a manner which did not lead to any considerable environmental transformations (e.g. Nalepka 2003; Nalepka *et al.* 2005: 105–106).

The mountain areas of the West Carpathians were occasionally infiltrated, which was connected with herding (perhaps seasonal) and (or maybe primarily) hunting. The longer stays of small groups of people who locally engaged in small-scale farming can also be taken into account (Margielewski *et al.* 2010a; 2010b; 2011; Nowak 2014).

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As to the dawn of the TRB in western Lesser Poland, the combination of all the available data and Bayesian modelling of all radiocarbon dates indicate that date *c.* 3750/3700 BC should be regarded as marking the most likely beginning of the process of its formation (Fig. 4; cf. also Nowak 2017). The ceramic typology does not exclude this possibility (Nowak 2009: 334–336, see further references), although this date is later than the commonly suggested date of 3950/3900/3800 BC (Włodarczak 2006; Kruk *et al.* 2016; Milisauskas *et al.* 2016; Kruk and Milisauskas 2018; Kruk *et al.* 2018). It has to be emphasised that the latter proposals has been based only on single date from the area under discussion (Bronocice) and – comparatively – other areas in Lesser Poland (Gnojno – Nowak 2006; Skołoszów – Rybicka *et al.* 2017), whose reliability can be challenged. The date of *c.* 3750/3700 BC does not contradict the stratigraphic relations between the Lublin-Volhynian culture and the TRB recorded at Bronocice because the general chronology of the Lublin-Volhynian culture in western Lesser Poland can be situated in *c.* 3900–3700/3600 BC (Nowak 2017; for a different opinion: Kruk *et al.* 2018: 36–38).

Around 3750/3700 BC, there were only several/a dozen or so "founding" sites of TRB in western Lesser Poland. In the period of 3750/3700–3500 BC this number should be still evaluated as rather low, but with increasing tendency. This could be so, since it seems possible that the late Lengyel-Polgár groups functioned in western Lesser Poland until the mid-4th millennium BC.

It is not possible, mainly due to lack of DNA data, to determine whether the origins of the local TRB were associated with some migrations (i.e. from either the Eastern Group of TRB or some areas in the upper Vistula Basin settled by TRB people before 3750/3700 BC) or with transformations of late Lengyel-Polgár cultural model. However, a relatively long period of postulated coexistence (at least 200 years) would suggest with a slightly higher probability the latter option. Some similarities in material culture (but – admittedly – of the second rank – Nowak 2004) could support such an idea (see also Kozłowski and Nowak 2018). Certainly, coeval external migrations and local cultural transformations cannot also be excluded as well as many possible mechanisms in between these two extreme processes.

Assemblages of the Modlnica type (Zastawny and Grabowska 2011), with pottery decorated with needle etching ornament (*Furchenstichkeramik*), most probably also mark a minor migration from the south-west (Moravia?) between ca. 3900 and ca. 3600 BC, to make the situation in the first half of the 4th millennium BC more complicated. Interestingly, this migration brought mixed pottery, consisting of Baalberge, epi-Lengyel and Hunyadihálom elements. Perhaps, this phenomenon accelerated the local transformation of the late Lengyel-Polgár culture into the TRB.

The time frame of *c.* 3500–3300 BC should be considered the heyday of the TRB in western Lesser Poland (Fig. 5). The majority of the hundreds or perhaps thousands of TRB sites should be referred to that time. It was then that the Neolithic settlement became evenly dispersed in the landscape, including topographical and ecological zones previously avoided by the "Danubians". On the other hand, it seems quite possible that in this period existed small groups of the Lengyel-Polgár culture origins that did not undergo "Funnel Beaker" acculturation, and started to accept some Transcarpathian, i.e. (mainly) Baden patterns. Such Baden patterns were accepted by some TRB groups as well (Zastawny 2018).

Until about 3300 BC, there was a small but growing occurrence of these patterns, but after that date they relatively quickly gained in importance. Their participation in pottery stylistics becomes so important that the TRB proper disappears from archaeological perspective. As a consequence, archaeologists felt obliged to discern a syncretic entity labelled "Beaker/Baden Assemblages" (B/BA) (Figs 6, 7). It should be emphasised that these Baden features are of archaic characteristics. They were known and used a bit before the aforementioned date 3300 BC. They must have been somehow preserved, i.e. through cutting the previous interactions with the Baden world.

The mechanisms behind these processes remain unclear, and a number of potential explanations can be proposed. Among the most convincing explanations is the simplest one, which posits that they were connected with a kind of "fashion" for the Baden culture. Baden elements, including pottery, became attractive and prestigious, and by virtue of their southern or south-western origin started to play the role of symbols of the leading civilisation centre of that period situated in the Balkans and Carpathian Basin.

Thus, the discussed process of western Lesser Poland "Badenisation" was of the internal nature, and consisted of the cultural development, perhaps accelerated since *c.* 3100 BC in the face of the Baden "invasion" (see below). Perhaps, it is no coincidence that the B/BA seems to concentrate in large settlements, most probably fortified (Kruk and Milisauskas 1999; Zastawny 2008), and the number of its sites seems to decrease when compared to "classic" TRB.

The B/BA discussed here occurs basically in the area of the eastern part of western Lesser Poland loess uplands. In the western part of the area under consideration, the Baden culture appeared *c.* 3100 BC (cf. Zastawny 2015b). Admittedly, this date is later

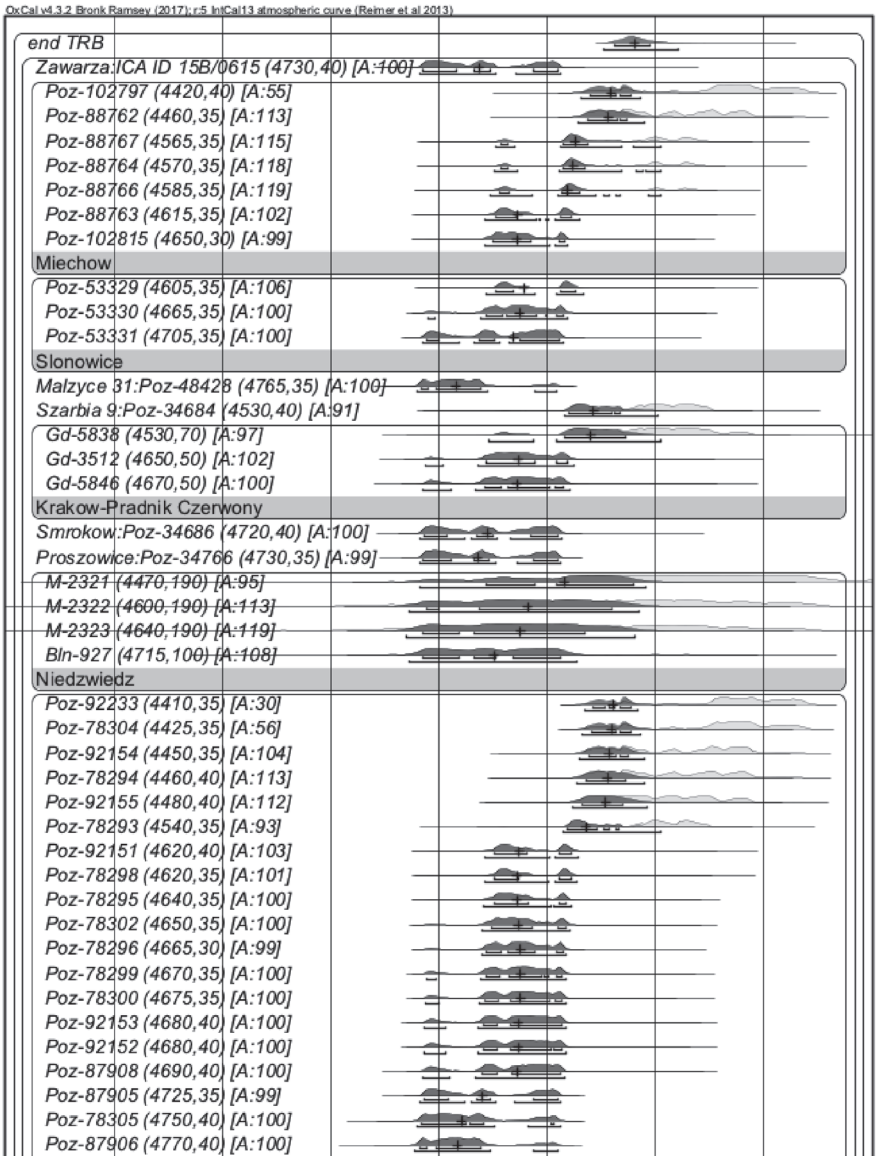

Fig. 4a. Bayesian modelling of radiocarbon dates of the Funnel Beaker culture; see references in Nowak 2017 and Kruk *et al.* 2018; part of dates from Mozgawa and all dates from Miechów have not been published so far; calibrations and modelling by the OxCal 4.3.2 package (Bronk Ramsey 2009; Reimer *et al.* 2013; Bronk Ramsey 2017).

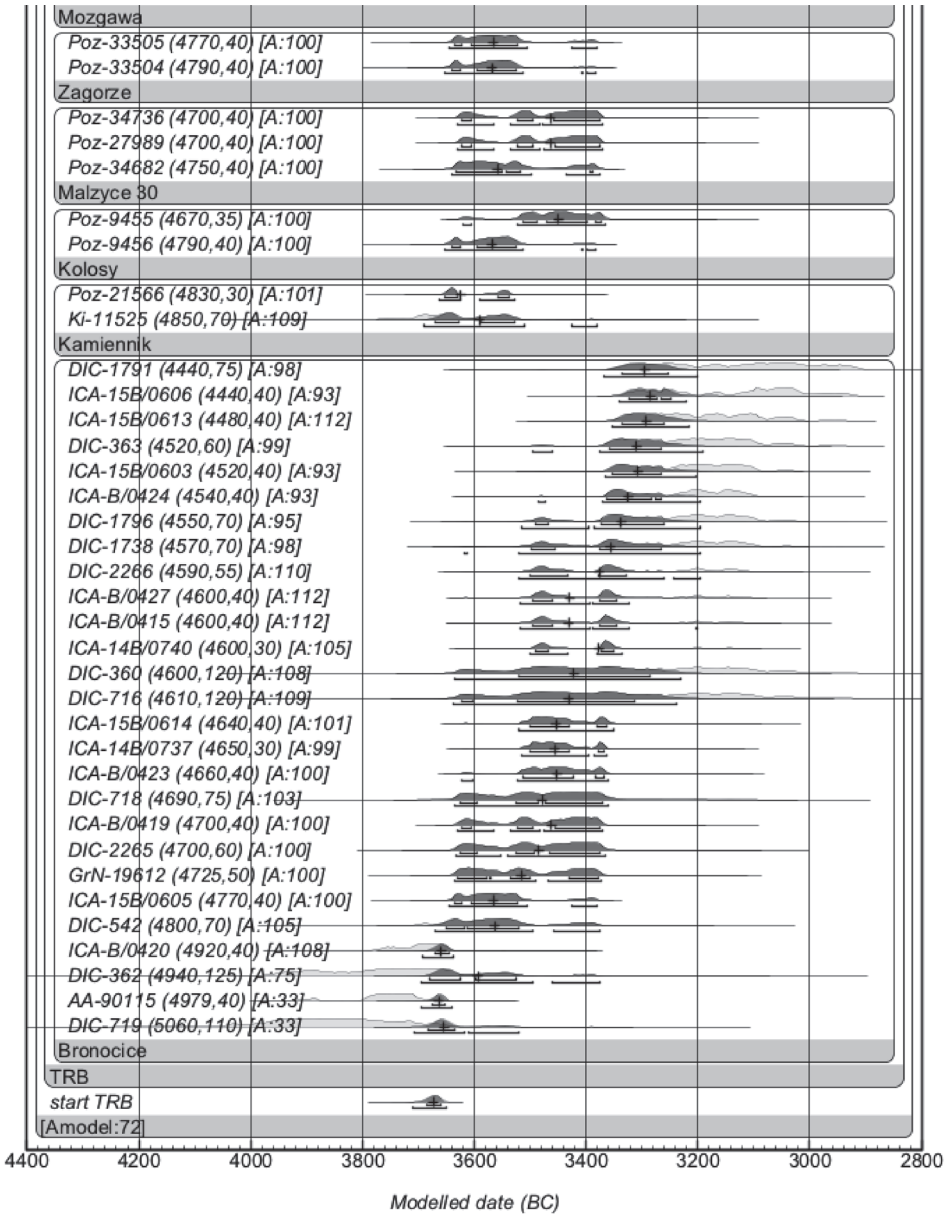

Fig. 4b. Bayesian modelling of radiocarbon dates of the Funnel Beaker culture (continued).

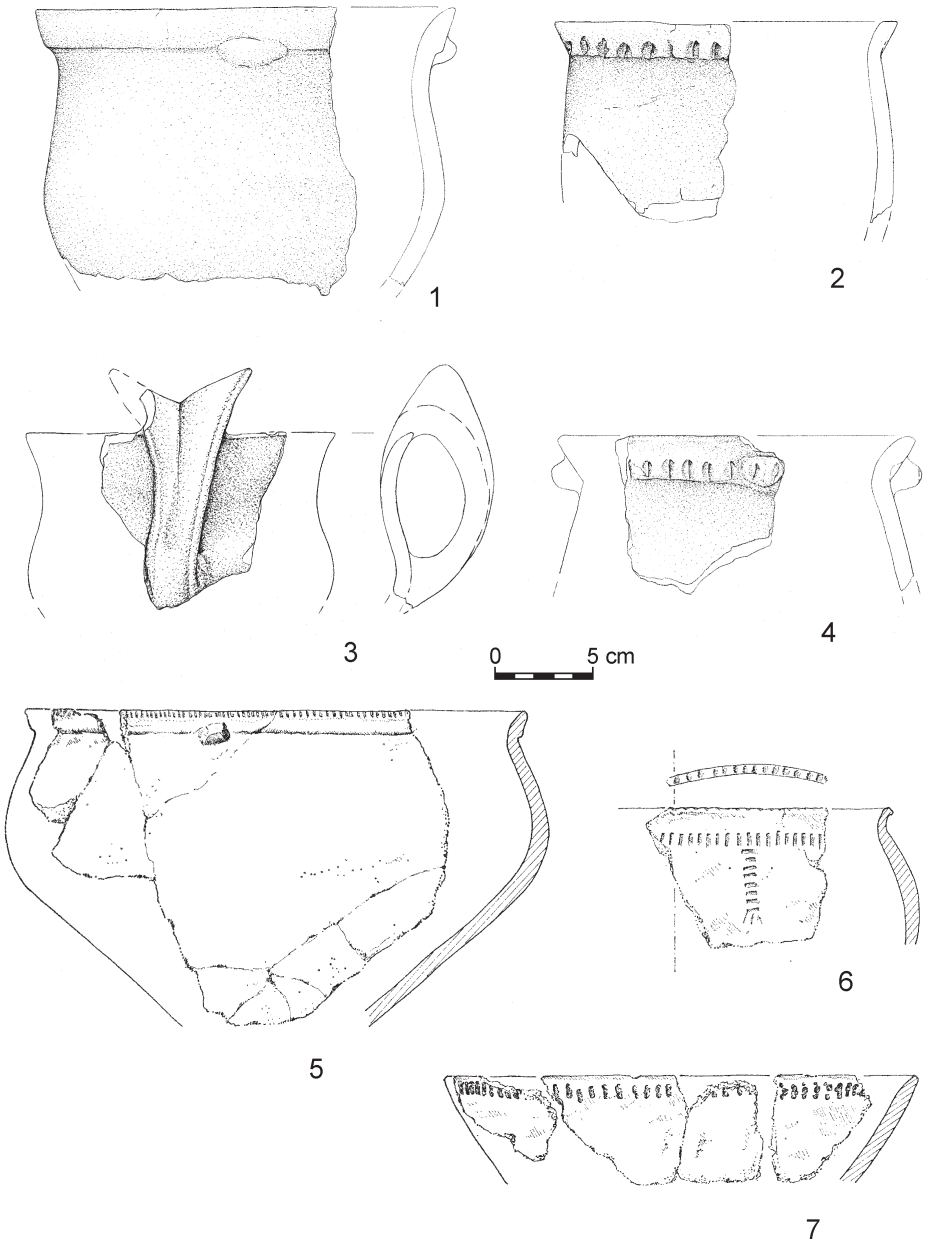

Fig. 5. Selected pottery of the Funnel Beaker culture: 1–4 – Mozgawa (unpublished, drawn by M. Korczyńska); 5–7 – Kraków-Prądnik Czerwony (after Rook and Nowak 1993).

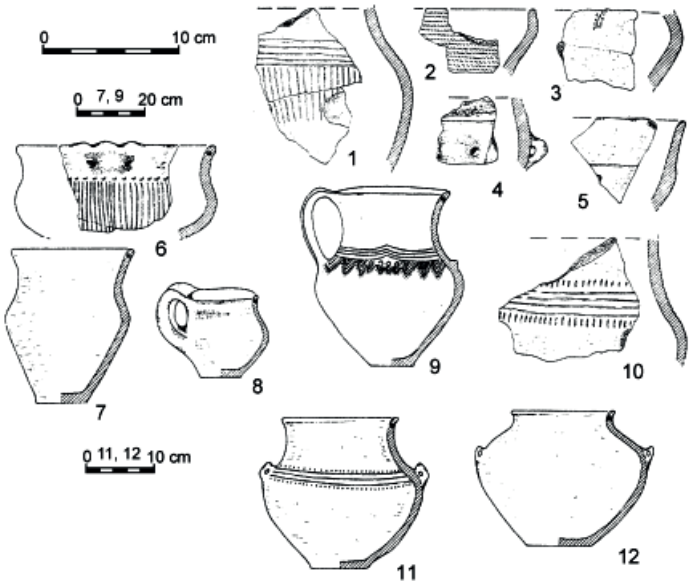

Fig. 6. Selected pottery of the Beaker/Baden assemblages at Bronocice: 1–10 – feature 2-B2, 11–12 – feature 1–A5 (after Kruk and Milisauskas 1990).

than could be expected before obtaining large series of 14C dates in recent years. However, these highly reliable datings indicate precisely this and no other situation. Besides, the proposed time interval does not contradict the overall principles of typological development and currently understood patterns of the absolute chronology of the Baden phenomena (Horvath and Svingor 2015; Zastawny 2008; 2011; 2015a).

These relatively late beginnings convincingly confirm what we had long suspected, namely that the Baden culture proper in western Lesser Poland appeared as the effect of rapid (a single wave?) migration from behind the Carpathians. This migration was executed by groups of people coming from its late classic stage. Consequently, those people brought here the model of the developed Baden culture, in all its aspects. They settled down in a small area within and around Cracow.

The lack of any TRB elements in materials of the Baden culture proper is particularly pregnant with meaning. Certainly, it corroborates the migration scenario, but also directly suggests that the TRB communities in the western part of the area under consideration could have been expelled or exterminated. A fairly sharp geographical boundary between the areas of the Baden culture and B/BA (Fig. 1; see Zastawny 2008: fig. 2; but cf. a bit different opinion in Włodarczak 2008b: 252) could also support an interpretation of this kind.

However, we have to admit that we do not possess any knowledge on the "cultural situation" in the western part of the territory under discussion (i.e. the Cracow agglomeration and surrounding areas) between *c.* 3300 and *c.* 3100 BC. There are neither TRB nor B/BA sites there with dates later than *c.* 3300 BC. Currently, two speculative hypotheses can be put forward to explain this: i) there were some groups with material culture of the B/BA type, unrecognised so far, ii) there were some earlier Baden groups, equally unidentified as yet (some finds of Baden pottery made during rescue works executed in Kraków-Nowa Huta in 2017 could tentatively support the latter option; information from J. Bober and A. Zastawny). The quantitative dimensions of the Niedźwiedź/Wyciąże materials (at least in the present state of research, cf. e.g. Nowak 2017; Zastawny 2018) seem to be too modest to represent this period, not to mention problems with its absolute and relative chronology. Similarly, the question of the existence of the TRB proper (i.e. non-Badenised), simultaneously with the B/BA and Baden culture remains open.

Little is also known about cultural situation in the mountain zone of SW Poland during the development of the Baden culture and B/BA. Was it still occupied by the TRB and/or the Baden culture groups? In the case of the latter, such a possibility is made obviously more likely by the fact that the Baden culture enclave in western Lesser Poland maintained contact with the core areas. However, there is no direct proof for such a conclusion.

The cause of the sudden disappearance of the B/BA as well as Baden culture around 2800 BC remains unclear. Results of performed Bayesian modelling of 14C dates (Nowak 2017; cf. also Fig. 7) suggest either the occurrence of a hiatus between this disappearance and the origins of the Corded Ware culture, or the political/historical nature of this archaeological change. In the latter case it would be a complex of events that included the removal and/or elimination of the B/BA communities by "Corded" communities, which represented a radically different type of culture. Perhaps these communities had moved to the region from the east (e.g. Allentoft *et al.* 2015).

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It turns out that in western Lesser Poland, the Funnel Beaker culture was perhaps never the only cultural unit. Even if such a situation was the case, it was limited to a relatively short period, of about 200 years, roughly in the mid-4th millennium BC (ca. 3550–3350 BC). How can this situation be interpreted from an anthropological and historical perspective? We believe that until the arrival of the Baden population around 3100 BC, this territory was occupied by the TRB populations, which genetically originated from the Lengyel-Polgár culture communities, but adopted and adapted new material culture (mainly pottery) and new patterns of settlement, subsistence,

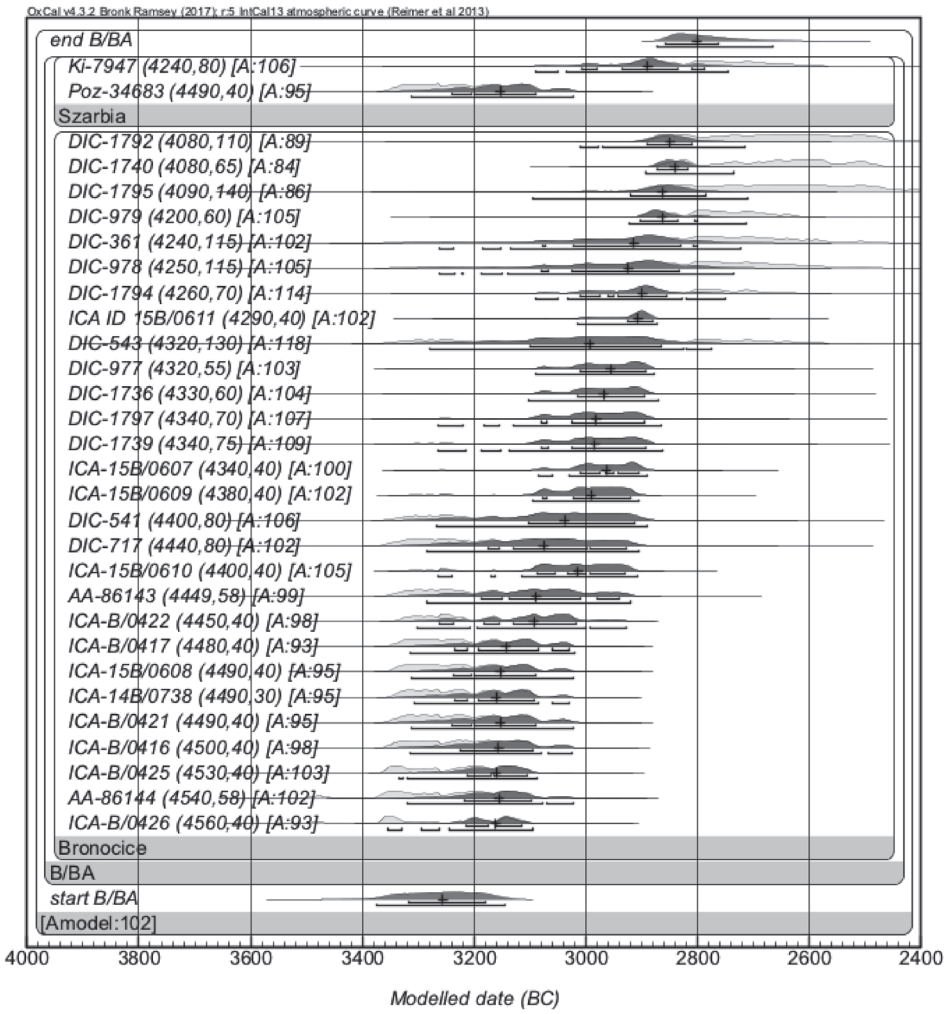

Fig. 7. Bayesian modelling of radiocarbon dates of the Beaker/Baden assemblages; see references in Nowak 2017 and Kruk *et al.* 2018; calibrations and modelling by the OxCal 4.3.2 package (Bronk Ramsey 2009; Reimer *et al.* 2013; Bronk Ramsey 2017).

ideology and – possibly – social structures. Processes of this kind were, however, varied in intensity. Therefore, the norm was a mixed situation in which one part of the local population used new patterns of material culture (and not only), while the other part preserved the old patterns. Certainly, the influx of "new" outsiders cannot be ruled out, but the "old" genetic pool predominated until beginning of the 31st century BC and in many places probably until 2800 BC. Interestingly, these Lengyel-Polgár turned

TRB populations were apparently still willing to adopt new cultural patterns. It is possible that their end around 2800 BC was also caused by political events, connected with the infiltration and expansion of Corded Ware culture groups.

The scenarios we have proposed above, particularly those referring to the appearance of the Baden culture proper and Corded Ware culture, may appear naïve, and surely out of fashion. They often assume an important role for political events and human agency rather than cultural transformations. What is more, they often regard some archaeological units as reflections of phenomena of political and – broadly speaking – historical dimension. Nevertheless, we believe that for this particular time and place they are just as probable as any other. If we look at historic times, described in written sources, it becomes clear that events of a political character as well as conscious human activity often influence, and sometimes even shape the history of humankind. Such interpretations are a rightful element of the set of tools to describe and explain this history.

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Chronology of the Funnel Beaker Culture Settlement in Western Ukraine in the Context of Radiocarbon Dating

Małgorzata Rybicka[a]

The article concerns the absolute dating of the Funnel Beaker culture over the upper Bug and the upper Dniester (Polish-Ukrainian borderland and western Ukraine). Also discussed are the relations of the community of this culture from the eastern zone of the south-eastern group with the Tripolye culture.

KEY-WORDS: Funnel Beaker culture, Tripolye culture, Western Ukraine.

INTRODUCTION

It has been 50 years since the publication of the work of Jan Kowalczyk (1969) under the title *Początki neolitu na ziemiach polskich* [*The Origins of the Neolithic Age on Polish Territories*]. The researcher referred in his work to the concepts of the genesis of the Funnel Beaker culture (FBC) generally accepted at that time, noting that *the influences in the formation of the European Neolithic from the southeast, between the Carpathians and the Black Sea, have been underestimated. The common opinion about the very late chronology of the Funnel Beaker culture in its southeastern area is a further confirmation of this fact* [...] (Kowalczyk 1969: 59). Taking into account the very early radiocarbon determination that had been obtained for a sample from Gródek on the Bug, Hrubieszów district, which he associated with the FBC (Kowalczyk 1968; 1969: 36), he stressed the importance of the upper Bug basin as a place that should be taken into account when considering the initiation of this cultural phenomenon. In his opinion, [...] *the emergence of the Tripolye culture in a large area between the Carpathians and the Dnieper* [...] *indicates that the Middle Eastern impacts were spreading from a powerful front facing north* (Kowalczyk 1969: 59). In addition, he believed that there had also

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been close contacts between the FBC and the Tripolye culture (TC), and the early dates obtained for the already well-developed "beaker"-materials from Gródek allowed them, and also the beginning of the FBC, to be assigned to an earlier period (Kowalczyk 1969: 60).

The matter of the mutual relationships between the western world, represented by the FBC communities, and the TC has been repeatedly raised in Polish, Russian and Ukrainian literature during the last 50 years (Zaharuk [Захарук] 1959; Zbenovich [Збенович] 1976; Balcer 1981; Kośko 1981; Movsha [Мовша] 1985; Videiko 2000; Rybicka 2017). On the other hand, studies on the chronology of the FBC in Western Ukraine have not yet been undertaken. The long term research conducted there by Mykola Peleshchyshyn of settlements of this culture, such as the Lysivka site, Vinnyky, Lviv Raion, the Tshub site at Lezhnitsa, Ivaniche Raion, and at Tadani, Kamianka-Buzka Raion (Peleshchyshyn [Пелещишин] 1990; 2004) have not yet become widely known in the scientific literature. This was probably the result of publishing only short reports in which only some of the results of fieldwork were presented. Until recently, no radiocarbon analyses have been carried out on samples from the known sites of the FBC, except for the settlement in Zimne (Bronicki *et al.* 2003).

As part of a project carried out at the Institute of Archaeology of the University of Rzeszów entitled *Studies on the eastern borderland of the Central European cultural province in prehistory and early Middle Ages*, headed by Andrzej Pelisiak, and the field director Jan Machnik, limited archaeological excavations have been carried out on the FBC settlement at the site Grodzisko (Horodyshche) III in Kotoryny on the upper Dniester (Hawinskyj *et al.* 2013). Their results showed the problems of this culture in Western Ukraine in a new light, both in terms of its chronology and spatial extent (Rybicka 2017).

The results obtained then, as well as the results of research carried out in the following years in the borderlands of the territories of the FBC and the TC in western Volhynia (Rybicka 2017), resulted in the next project (NCN Opus 8 UMO 2014/15/B/HS3/02486): *Between the East and the West. Dynamics of Social Changes from the Eastern Carpathians to the Dniepr in the 4th – beginning of the 3rd Millennium BC*. One of its main goals was to determine the character and chronology of contacts between these cultures.

The tasks undertaken in this project, still in progress at the time of writing, have highlighted the importance of the FBC and its contacts with the TC (Rybicka 2017), and also indicated the importance of the absolute dating of the cultural phenomena taking place there (Rybicka *et al.* 2019). It is particularly important to determine the time of appearance and disappearance of the "Beaker People" communities in western Ukraine.

According to Sławomir Kadrow (2005: 13), the functioning of the first settlement phase of the FBC in Zimne can be dated between 3650–3400 BC, i.e. a similar period

as the first stage of settling by these communities on the Bug river, such as in Gródek, Hrubieszów district (Włodarczak 2006: 51). This researcher assigns the second phase in Zimne to the period 3050–2600 BC. Piotr Włodarczak (2006: 51), however, dates it to 3100–2800 BC. This dating diverges to a considerable extent from the adopted time frames for the functioning of the second stage of the settlement of Gródek, which is assigned to the period 3400–3100 BC (Włodarczak 2006: 51). These discrepancies show the difficulties in determination of the dating the later stages of the FBC in the Bug river region.

The re-analysis of the radiocarbon dates received for the eastern and south-eastern group of the FBC is an important element of discourse in recent years in the literature. The works of Marek Nowak (2009), Piotr Włodarczak (2006), Janusz Kruk and Sarunas Milisauskas (2018) are part of this trend. In this connection, we should revisit the results of radiocarbon dating received for the FBC from western Ukraine.

CRITICAL ANALYSIS OF THE AVAILABLE RADIOCARBON DATES FOR THE FUNNEL BEAKER CULTURE SETTLEMENTS FROM WESTERN UKRAINE

Lack of good starting materials for radiocarbon dating from previously researched sites, such as Mali Hrybovychi, Zhovkva Raion (Havinskyi [Гавінський] 2009), Rudniki, Mykolaiv Raion or the Lysivka site at Vynnyky, (Havinskyi, Pastekevich [Гавінський, Пастеркевіч] 2016), hinders situating in time the functioning the FBC communities in western Ukraine. That is why such a large significance is now attributed to the series of dates obtained in the 1990s from the site in Zimne (Bronicki *et al.* 2003), and in recent years from the settlements of the Grodzisko (Horodyshche) III site at Kotoryny. In addition, we have single 14C determinations for the settlement in the Lysivka site at Vynnyky, and for the FBC from the site Podobanka at Novomalin, Ostroh Raion (Hawinskyj *et al.* 2013; Rybicka 2017). The quoted sites represent several different regions of the oecumene of this culture: the area on the upper Dniester, on the upper Bug, the eastern Roztocze and western Volhynia.

Zimne, Volodymyr-Volynskyi Raion

In the case of the site in Zimne, Volodymyr-Volynskyi Raion, 12 radiocarbon determinations made with the scintillation method from animal bones were associated with material of the FBC (Bronicki *et al.* 2003: 33). Several dates obtained from the samples taken from the floors of the pits No. 30/97 and 8/97 correspond to the classical stage of this culture. They are respectively: 4920±50 BP (Ki–6873), 4770±60 BP (Ki–6874) and 4740±45 BP (Ki–6878), 4660±55 BP (Ki–6877). For each of subsequent features (No. 2/97, 5/97, 3/97) also two differing from each other dates were obtained, made from various samples. The following results were obtained: feature No. 2/97: 4390±55 BP

(Ki–6875) and 4230±50 BP (Ki–6876); feature No. 5/97: 4350±55 BP (Ki–6879) and 4260±50 BP (Ki–6880); feature No. 3/97: 4295±60 BP (K–6872 and 4160±50 BP (Ki–6871). In the case of features No. 2/97 and 5/97, the samples analysed came from their upper parts (Bronicki *et al.* 2003; Rybicka *et al.* 2019). Some dates were obtained from samples coming from the upper fills of shallow pits, including feature No. 3/97 and subsequent ones, with numbers: 31/97 and 32/97, for the latter they are: 4120±50 BP (Ki–6870) and 4080±55 BP (Ki–6869).

In the back-filled depressions of archaeological features, are often deposited materials originating from another phase of the site not corresponding to the date of the feature itself (Kadrow 1991), which reduces the value of dates obtained from samples taken from these places. The dating results of organic material from pits 31/97 and 32/97 therefore seem to be debatable, the more so because they do not correspond to the result of the archaeological analysis of pottery – they are too late in relation to this. Of particular concern are the very late results obtained for features 31/97 and 32/97, whose context is not certain. It can be assumed that they do not refer to the FBC.

Sławomir Kadrow, justifying the discrepancy between the dating of the second settlement phases of the FBC in Gródek and Zimne, links it with the regional diversity of this culture, following the classical period (Kadrow 2005: 13).

It is possible to assign the identified imports found in deposits of the second settlement phase in Gródek with those characteristics of the Gordineşti group (Dergachev [Дергачев] 1980; Sirbu [Сырбу] 2016), which in western Volhynia is represented by such settlements as Holyshiv, Lutsk Raion and Lystvin, Dubno Raion (Rybicka 2017: 53–59); however, there is no radiocarbon dating for them. For assemblages representing the late stages of the TC, such as Vynnyky-Zhupan, the Lviv Raion (Fig. 1), Gordineşti and Hancauti, Edineț district, we now have a number of dates made of samples of good quality: cereals and animal bones coming from discrete features. They point to a period of about 3300–3000/2900 BC (Table 1; Rybicka 2017: 133; Rybicka *et al.* 2019).

Also in materials from the late-beaker settlement in Zimne, some late Tripolyean traits, such as small globular amphorae or deep bowls painted with black paint, were identified, which Sławomir Kadrow, taking into account Taras Tkachuk's opinions, assigns to the Horodiştea and Gorodsk groups. He also wrote *that the impact of this phase of the Tripolye culture appears in the form of "beaker" vessels with notches for the lid, bowls with a bevelled rim, and ornamented by an imprinted cord* (Kadrow 2005: 13). Vessels with notches for the lid were also noted in Pawłosiów, site 52, located on the Rzeszów-Przemyśl loess areas, where they can be dated to 3500–3350 BC (Rybicka *et al.* 2014: 193, table XXX: 2). Their presence was also noted in Piaski Wielkie in the Lublin region (Dobrzyński 2011: Fig. 9: 3, 6, 10: 10). Dates varying between 3600–3330 BC were obtained for two features from this site, and for one – a date of 3350–3100 BC (Dobrzyński 2011: 78). In the style of the pottery assemblage from Pawłosiów, site 52, Baden influences were also distinguished, in the form of the occurrence of single

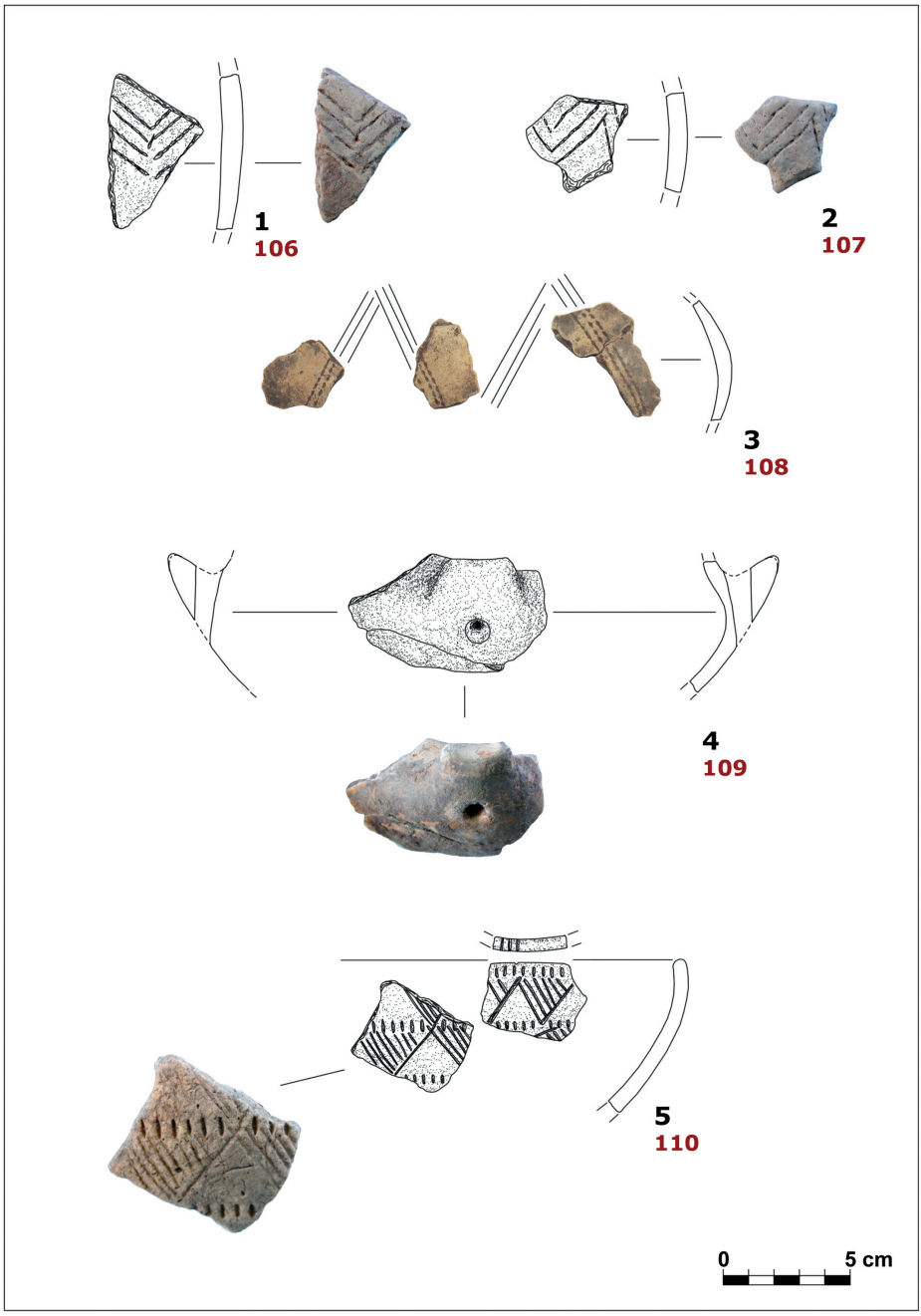

Fig. 1. Zhupan site, Vynnyky near Lviv, pottery of the Tripolye culture.

Table 1. Radiocarbon dating of the CII stage of the Tripolye culture.

No.	Site, feature, sample type	Radiocarbon determination	**Probability 68.2%**	**Probability 95.4%**	**Literature**
1.	Novomalin-Podobanka, Rivne Oblast;vegetal remains in pottery of the Funnel Beaker culture	Poz–55979 4670±40 BP	3516 BC (16.6%) 3488 BC 3472 BC (44.3%) 3398 BC 3389 BC (7.3%) 3372 BC	3627 BC (6.7%) 3597 BC 3526 BC (88.7%) 3363 BC	Rybicka 2017, further literature there
2.	Brinzeni III, Edinet District; ploshchadka 7; animal bones	*Poz–4560±35 BP	3368 BC (68.2%) 3124 BC	3489 BC (95.4%) 3104 BC	Unpublished analysis financed by NCN UMO 2014/15/BHS3/02486
3.	Zhvaniets, Khmelnytskyi Raion; ploshchadka 1; animal bones	Ki–6745 4530±50 BP	3360 BC (16.1%) 3310 BC 3300 BC (3.1%) 3260 BC 3240 BC (49.0%) 3110 BC	3370 BC (93.4%) 3080 BC 3060 BC (2.0%) 3030 BC	Rassamakin 2012, further literature there
4.	Zhvaniets, Khmelnytskyi Raion; hut 2, animal bones	Ki–6743 4480±40BP	3340 BC (46.2%) 3210 BC 3190 BC (11.15%) 3150 BC 3130 BC (11.9%) 3090 BC	3350 BC (87.1%) 3080 BC 3070 BC (8.3%) 3020 BC	Rassamakin 2012, further literature there
5.	Kurgany-Dubova, Rivne Oblast; vegetal remains in pottery of the Tripolye culture	Poz–77974 4500±35 BP	3336 BC (26%) 3265 BC 3241 BC (12.6%) 3210 BC 3193 BC (16.6%) 3151 BC 3138 BC (13.0%) 3105 BC	3336 BC (26%) 3265 BC 3241 BC (12.6%) 321 BC 3193 BC (16.6%) 3151 BC 3138 BC (13.0%) 3105 BC	Rybicka 2017, further literature there
6.	Gorodsk, Zhytomyr Raion	GrN–5099 4651±35 BP	3510 BC (58.4%) 3420 BC 3380 BC (9.8%) 3360 BC	3520 BC (95.4%) 3350 BC	Rassamakin 2012, further literature there
7.	Gorodsk, Zhytomyr Raion	Ki–6752 4495±45 BP	3340 BC (26.6%) 3260 BC 3250 BC (28.1%) 3150 BC 3140 BC (13.4%) 3100 BC	3360 BC (89.9%) 3100 BC 3070 BC (5.5%) 3020 BC	Rassamakin 2012, further literature there
8.	Troyaniv, Zhytomyr Raion; animal bones	Ki–6748 4360±55 BP	3390 BC (5.0%) 3060 BC 3030 BC (63.2%) 2900 BC	3320 BC (4.9%) 3230 BC 3120 BC (90.5%) 2880 BC	Rassamakin 2012, further literature there
9.	Troyaniv, Zhytomyr Raion; ploshchadka I; animal bones	Ki–6749 4410±50 BP	3270 BC (0.7%) 3250 BC 3100 BC (67.5%) 2920 BC	3330 BC (18.9%) 3210 BC 3190 BC (3.3%) 3150 BC 3130 BC (73.3%) 2900 BC	Rassamakin 2012, further literature there
10.	Troyaniv, Zhytomyr Raion; house25	Ki–6750 4430±45 BP	3320 BC (16.2%) 3230 BC 3110 BC (38.9%) 3000 BC 2990 BC (13.2%) 2930 BC	3340 BC (27.3%) 3210 BC 3190 BC (5.3%) 3150 BC 3130 BC (62.9%) 2920 BC	Rassamakin 2012, further literature there

No.	Site, feature, sample type	Radiocarbon determination	**Probability 68.2%**	**Probability 95.4%**	**Literature**
11.	Hancauti, Edinet District; oven No. 1	*Poz–4445±35 BP		3335 BC (36.6%) 3211 BC 3192 BC (7.3%) 3152 BC 3138 BC (45.4%) 3007 BC 2988 BC (6.2%) 2931 BC	Sirbu (Сырбу) 2016: 121
12.	Zhvaniets, Khmelnytskyi Raion; charcoal	Ki–6754 4380±60 BP	3090 BC (68.2%) 2910 BC	3330 BC (12.7%) 3210 BC 3180 BC (1.7%) 3150 BC 3130 BC (81.0%) 2890 BC	Rassamakin 2012, further literature there
13.	Zhvaniets, Khmelnytskyi Raion; animal bones	Ki–6744 4355±60 BP	3090 BC (5.1%) 3060 BC 3030 BC (63.1%) 2900 BC	3330 BC (6.2%) 3230 BC 3120 BC (89.2%) 2870 BC	Rassamakin 2012, further literature there
14.	Zhvaniets, Khmelnytskyi Raion; charcoal	Ki–6753 4290±55 BP	3020 BC (68.2%) 2870 BC	3090 BC (84.1%) 2850 BC 2820 BC (9.0%) 2740 BC 2730 BC (2.3%) 2690 BC	Rassamakin 2012, further literature there
15.	Gordineşti II–3, Edinet District; house 1 (2016); wheat	Poz–83658 4480 ±35 BP	3331 BC (46.0%) 3215 BC 3185 BC (10.5%) 3157 BC 3126 BC (11.6%) 3096 BC	3342 BC (89.4%) 3086 BC 3061 BC (6.0%) 3029 BC	Unpublished analysis financed by NCN UMO 2014/15/BHS3/02486
16.	Gordineşti II–4, Edinet District; house I (2016); wheat	Poz–83659 4480 ±35 BP	3331 BC (46.0%) 3215 BC 3185 BC (10.5%) 3157 BC 3126 BC (11.6%) 3096 BC	3342 BC (89.4%) 3086 BC 3061 BC (6.0%) 3029 BC	Unpublished analysis financed by NCN UMO 2014/15/BHS3/02486
17.	Gordineşti II–5, Edinet District; house I (2016); wheat	Poz–83660 4475 ±35 BP	3331 BC (45.7%) 3215 BC 3185 BC (10.0%) 3157 BC 3126 BC (12.5%) 309 3BC	3341 BC (87.1%) 3083 BC 3067 BC (8.3%) 3027 BC	Unpublished analysis financed by NCN UMO 2014/15/BHS3/02486
18.	Gordineşti II–2, Edinet District; house I (2016); animal bones	Poz–83728 4430 ±35 BP	3331 BC (46.0%) 3215 BC 3185 BC (10.5%) 3157 BC 3126 BC (11.6%) 3096 BC	3342 BC (89.4%) 3086 BC 3061 BC (6.0%) 3029 BC	Unpublished analysis financed by NCN UMO 2014/15/BHS3/02486
19.	Vynnyky–Zhupan, Lviv Raion; animal bones from the feature 1of the Tripolye culture	Poz–84779 4430±35 BP	3308 BC – 2941 BC	3328 BC – 2925 BC	Unpublished analysis financed by NCN UMO 2014/15/BHS3/02486; Rybicka 2017
20.	Horodnita-Horodiste	GrN–5088 4615±35 BP	3500 BC (43.5%) 3450 BC 3380 BC (24.7%) 3350 BC	3520 BC (94.2%) 3330 BC 3210 BC (1.25%) 3190 BC	Rassamakin 2012, further literature there

No.	Site, feature, sample type	Radiocarbon determination	**Probability 68.2%**	**Probability 95.4%**	**Literature**
21.	Horodistea I; animal bones	Hd–14785 4495±18 BP	3340 BC (26.9%) 3260 BC 3240 BC (14.5%) 3210 BC 3190 BC (15.5%) 3150 BC	3340 BC (95.4%) 3090 BC	Rassamakin 2012, further literature there
22.	Horodistea II; animal bones	Hd–15024 4377±21 BP	3015 BC (68.2%) 2925 BC	3090 BC (6.9%) 3060 BC 3030 BC (88.5%) 2910 BC	Rassamakin 2012, further literature there
23.	Horodistea II; animal bones	Hd–14898 4235±30 BP	2910 BC (52.0%) 2870 BC 2810 BC (16.2%) 2770 BC	2910 BC (60.1%) 2850 BC 2810 BC (30.1%) 2750 BC 2730 BC (5.2%) 2700 BC	Rassamakin 2012, further literature there
24.	Sofievka, Kiev Oblast; human bones from a cremation grave	Ki–5012 4320±70 BP	3090 BC (3.5%) 3060 BC 3030 BC (64.7%) 2880 BC	3350 BC (95.4%) 2650 BC	Rassamakin 2012, further literature there
25.	Sofievka, Kiev Oblast; charcoal from the feature 50	Ki–5029 4300±45 BP	3010 BC (13.7%) 2980 BC 2940 BC (54.5%) 2870 BC	3090 BC (1.8%) 3060 BC 3030 BC (92.2%) 2870 BC 2810 BC (1.4%) 2770 BC	Rassamakin 2012, further literature there
26.	Sofievka, Kiev Oblast; burnt human bones	Ki–5013 4270±90 BP	3030 BC (45.4%) 2850 BC 2820 BC (16.5%) 2740 BC 2730 BC (6.3%) 2680 BC	3350 BC (1.6%) 3200 BC 3150 BC (93.8%) 2550 BC	Rassamakin 2012, further literature there
27.	Verteba Cave, Bilche Zolote, Borshchiv Raion	Ki–8270 4280±90 BP	3080 BC (1.5%) 3060 BC 3030 BC (45.7%) 2850 BC 2820 BC (15.6%) 2740 BC 2730 BC (5.4%) 2690 BC	3350 BC (95.4%) 2550 BC	Rassamakin 2012, further literature there
28.	Sandraki, Vinnytsia Oblast; animal bones	Ki–6746 4175±50 BP	2879 BC (13.0%) 2848 BC 2813 BC (55.2%) 2679 BC	2893 BC (95.4%) 2620 BC	Rassamakin 2012, further literature there
29.	Sandraki, Vinnytsia Oblast; animal bones	Ki–6747 4210±45 BP	2900 BC (22.4%) 2850 BC 2810 BC (35.2%) 2750 BC	2910 BC (30.6%) 2750 BC 2820 BC (63.25%) 2660 BC 2650 BC (1.6%) 2630 BC	Rassamakin 2012, further literature there
30.	Tsviklovtse, Khmelnytskyi Raion; human bones from a cremation grave	Ki–6751 3960±50 BP	2570 BC (25.3%) 2510 BC 2500 BC (28.0%) 2430 BC 2420 BC (5.3%) 2400 BC 2380 BC (9.5%) 2340 BC	2580 BC (95.4%) 2290 BC	Rassamakin 2012, further literature there

* The laboratory did not give numbers to the analysed samples.

handles with knobs. Identical traits were also recorded in the materials of the Troyaniv and Gorodsk group (Videiko 2000), dated to the end of the fourth millennium BC (Table 1). Sławomir Kadrow (2005: 14, Fig. 18, cf. Włodarczak 2006: 47–49) sees this type of decoration, having regard to the dating of the Sofievka group of the TC, as relating to influences from the Kostolac-Coţofeni-Cernavoda II and Sitagroi Va – Radomir I–II – Junacite XIII–IX cultures. He does not consider that these include decorative inspiration from the northern Moldavian Gordineşti group of the TC, which is also characterised by pottery with similar stylistic features (Dergachev [Дергачев] 1980; Sirbu [Сырбу] 2016). It seems that the time of functioning of this group is now well defined and can be placed in the period 3300–3000/2900 BC (cf. Rybicka 2017).

The pottery of the FBC originating from the pits No. 2/97 and 5/97 in Zimne (Bronicki *et al*. 2003) corresponds in terms of stylistics, for example, to ceramics from the Tshub site at Lezhnitsa, (Rybicka *et al.* 2019), but the dates obtained for these features raise doubts. In material from both mentioned settlements, in the methods of shaping rims and their edges (e.g. Bronicki *et al*. 2003: Figs 11: 11; 14: 15) have been noticed – distant analogies to the pottery morphology of the TC of Kurgany type from the Dubova site, Ostroh Raion (Verteletskyi [Вертелецкий] 2016), which is dated to the end-phase of the fourth millennium BC (Table 1).

To sum up, the stylistics of the ceramics originating from some features from Zimne may be compared to the material from the site of Lysivka at Vynnyky, and from the Tshub site at Lezhnitsa (Rybicka *et al*. 2019), and chronologically probably corresponds to the second phase of the functioning of the settlement at Gródek.

Grodzisko (Horodyshche) III site, Kotoryny, Zhydachiv Raion

Also in the case of Kotoryny (Grodzisko [Horodyshche] III site), the situation in time of the settlement remains of the FBC is not unambiguous in the context of the radiocarbon determinations obtained and the identification there of the distinguishing features of the early-Funnel Beaker phase (cf. Hawinskyj *et al*. 2013; Rybicka 2016). The presence in a floor of features of numerous ceramic finds with traits corresponding to the style of the early stages of the eastern group of this culture justifies the acceptance of early radiocarbon determinations obtained for the material from pits in trench No. 1, such as 4890±100 BP (MKL–888) and 4845±35 BP (Poz 44004, see Hawinskyj *et al*. 2013). The distinction in the ceramic material of references to the classical variety of the south-eastern group, such as handles of *lunata* type or curved rim profiles, also corresponds to the obtained 14C determinations, and consequently makes possible dating of the first settlement phase of the FBC to the time range of 3650–3400 BC. The problem is, however, the cultural interpretation of several determinations representing the beginnings of the third millennium BC. A number of the distinguished features of the pottery decoration at Kotoryny, such as, for example, handles of *lunata*

type, *Furchenstich*, arcaded ornament, etc., were in use over a wide range in time (Włodarczak 2006: 52). However, there are also stylistic traits that can be assigned to the later stages of this culture, e.g. a wide *Furchenstich* and references to the style of the Baden Culture (Fig. 2). The so-called caterpillar stitch may be dated to a period of about 3400–3100 BC (Dobrzyński 2011: 76–78; Hawinskyj *et al*. 2013: 266; Rybicka *et al*. 2019). The Baden elements present at Kotoryny can be assigned to the early stages of this cultural circle (cf. Fig. 2; Furholt 2009: 149–151). In this collection, however, there is neither late Tripolyean pottery nor its specific stylistic traits.

In the group of thirteen 14C determinations from Kotoryny, the majority (12 dates) were made by scintillation from charcoal, and only one animal bone was dated by the AMS method. The oldest date: 5860±80 BP (MKL–795), obtained for the pit No. 27, cannot be related to the FBC. It is probably the effect of dating secondarily deposited charcoals. Two consecutive dates were obtained for the base and top of the fill of this feature: 4630±90 BP (MKL–802) and 4620±70 BP (MKL–796), well correlating with the stylistic traits of the ceramics derived from it (Hawinskyj *et al.* 2013: 254). The dating resulting from analysis of animal bone from pit No. 26: 4845±35 BP (Poz–4404), corresponds to the result obtained for charcoals from pit No. 4: 4890 ±100 BP (MKL–888). The results obtained are a positive verification of the dates derived from the stylistic characteristics of ceramics (Hawinskyj *et al.* 2013: 235, 237). On the other hand, more disputable results came from samples from the post holes in trench II with the numbers: 26, 32 and 28, respectively: 5090±140 BP (MKL–884), 4690 ± 110 BP (MKL–883) and 4240±90 BP (MKL–794). The large discrepancy between these dates makes their relationship with the FBC uncertain. The first two of them with a greater or lesser degree of probability match the dating of the ceramic stylistic traits from this trench, which are well represented by the material from the pit No. 27. The third result, however, does not correspond to the stylistic characteristics of these ceramics. For the shallow depression, referred to as pit No. 15, two clearly different determinations were obtained: 5290±90 BP (MKL–885) and 4090±90 BP (MKL–892). In this case, one cannot determine what in fact they date. Such a large discrepancy means that they should be omitted in the assessment of the chronology of the remains of the FBC in Kotoryny. The same applies to the date of a charcoal sample from a shallow depression, the so-called pit No. 17: 4230±130 BP (MKL–889). However, the dating results obtained for a charcoal sample from the rampart and the pit No. 4a: 4520±70 BP (MKL–890) and 4420±90 BP (MKL–798) should be assigned to the settlement of Funnel Beaker times. It seems from the presented remarks that only a few determinations were made of samples from good contexts; these are the material from pits No. 4, 4a, 26, 27 as well as the layer under the rampart. The value of the others is questionable.

If we include only the radiocarbon dates from the sites in Kotoryny and Zimne, which correspond to the accepted stylistic dating of the ceramics derived from them and representing good contexts, the FBC in Western Ukraine can be dated to the period

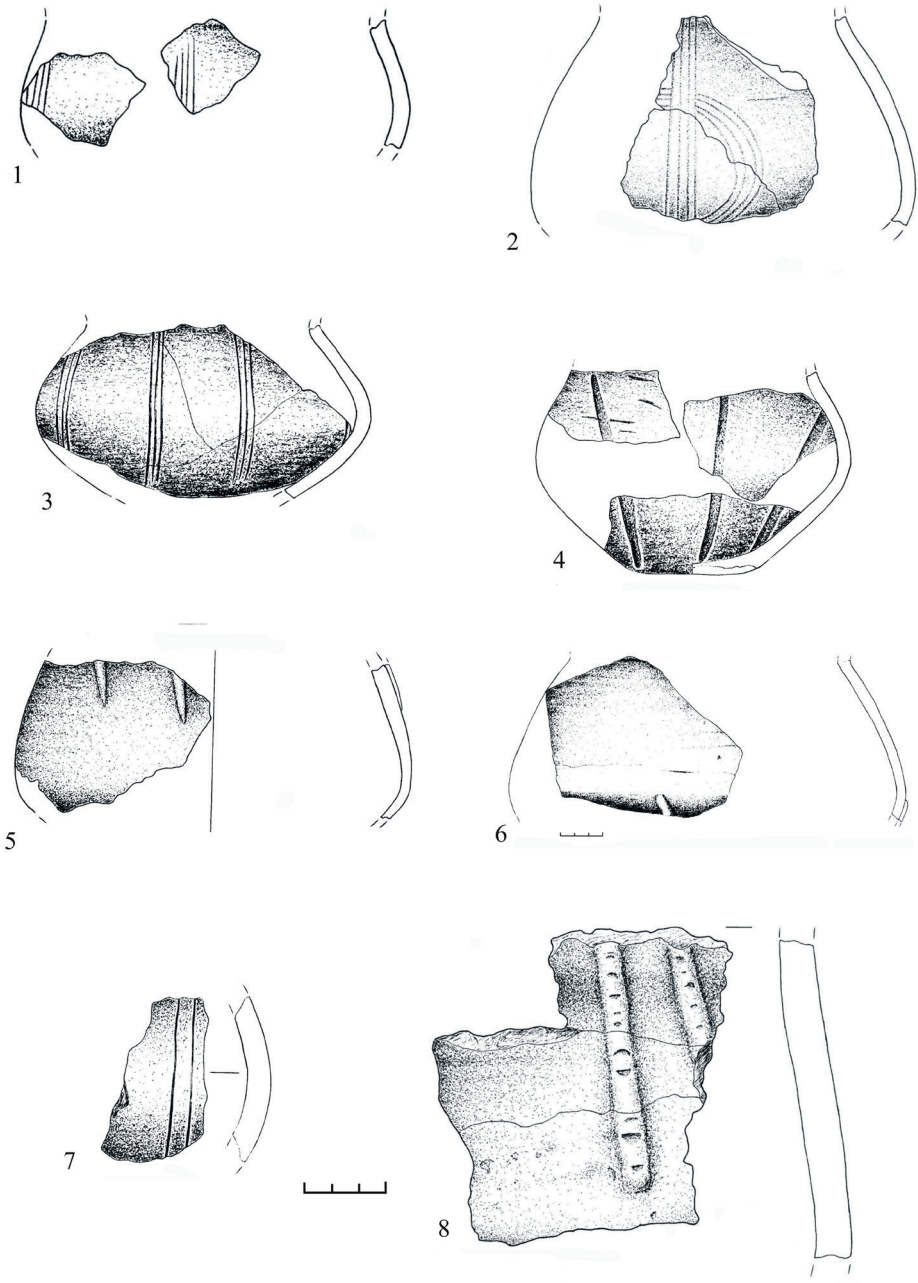

Fig. 2. Kotoryny near Zhydachiv, Grodzisko (Horodyshche) III site.
Pottery of the Funnel Beaker culture.

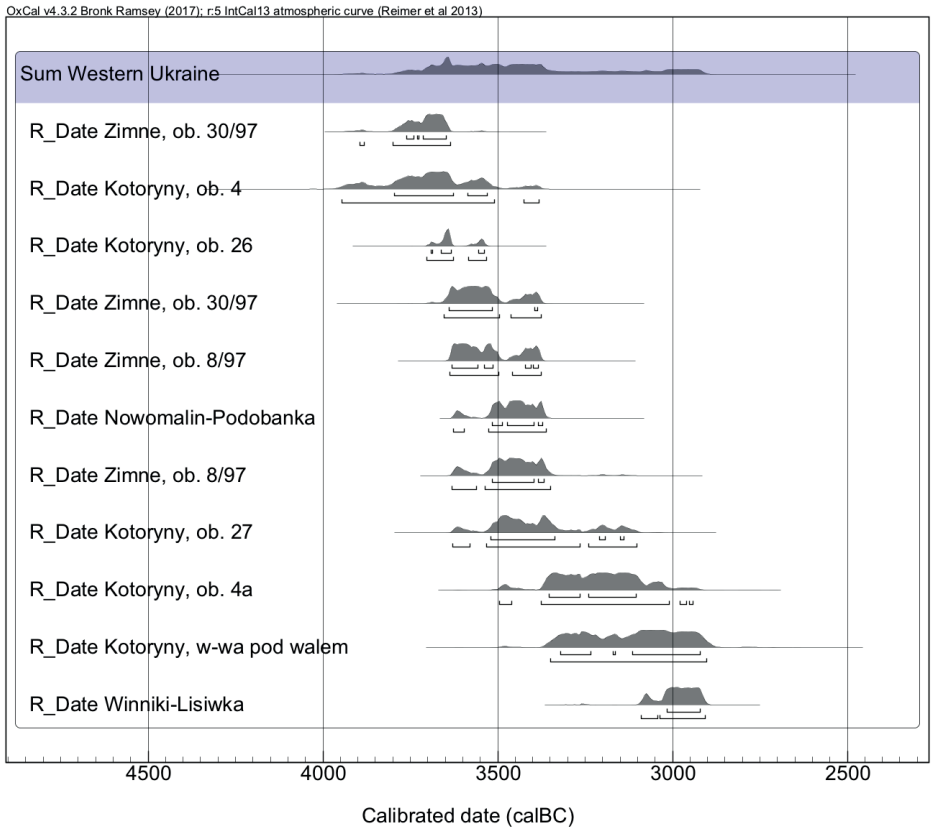

Fig. 3. Dating of the Funnel Beaker culture in Western Ukraine.

3700/3600 – 3000/2900 BC (Fig. 3). Generally, this corresponds to the chronology of the settlement in Gródek (Włodarczak 2006), and the Gordineşti group could be also included in it (Table 1). The presence of traits representing this culture both in Gródek (Rybicka 2017) and in Zimne (Kadrow 2005) confirms the above presented suggestion.

CONCLUSIONS

The dates obtained for Gródek and cited by Jan Kowalczyk (1969) as justifying the very early emergence of the FBC in the Bug River region, have been subjected to verification (Bronicki *et al.* 2003: 31; Włodarczak 2006: 33). The repeated analysis of one of these samples resulted in a much later result, which corresponds to the date

range of the classical stage of the south-eastern group of this culture, ascertained for assemblages from Bronocice (Kruk and Milisauskas 2018). Dates associated with the early-beaker stylistics at Kotoryny (Grodzisko [Horodyshche] III site) are not conformable with the concept of Jan Kowalczyk (1969) regarding the chronology of the initiation of this culture in western Ukraine. However, they justify, just like the stylistics of the ceramics, the emergence of the FBC in this area at a similar time as in the Rzeszów-Przemyśl loess areas (cf. Rybicka 2016). The problem is, however, to determine the date of its disappearance, both in the Bug region and on the upper Dniester. An unequivocal explanation of this issue requires conducting more radiocarbon analyses for samples of "short-lived" materials coming from homogeneous contexts (e.g. cereals, animal bones). At present, it seems that the disappearance of the FBC in those regions can be assigned to the turn from the fourth to the third millennium BC. This is indicated by the presence of imports from the Gordineşti group at Gródek (Gumiński 1989; Włodarczak 2006) and Zimne (Kadrow 2005).

Translated by Andrzej Leligdowicz

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The Funnel Beaker and Globular Amphora Cultures in the Sandomierz Upland in the Light of Settlement Research

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The article concerns the Neolithic settlement structures of the Funnel Beaker and Globular Amphora cultures in the Sandomierz Upland, discussed comparatively in the context of interrelationships and relationships with the exploitation of flint raw materials, especially of banded flint.

KEY-WORDS: Funnel Beaker culture, Globular Amphora culture, Sandomierz Upland, Neolithic settlement, flint raw materials.

INTRODUCTION

The Sandomierz Upland – a mesoregion in the current physical and geographical division of Poland (Kondracki 1978: 361), limited by the valleys of the Vistula and Kamienna rivers and the range of the Świętokrzyskie Mountains, covering an area of about 1100 km^2 – was and is considered one of the key regions for research on Neolithic. Its importance was noticed and appreciated quite early by researchers studying the Late Stone Age, which resulted in undertaking many pieces of fieldwork and the accumulation of a large amount of material evidence. This provides a good starting point for further research, including on the long term evolution of settlement in the Neolithic. It has become possible to trace the variability of settlement structures at various levels of complexity, as well as to determine the nature and direction of settlement processes (Kowalewska-Marszałek 1992). On the other hand, a major difficulty is generally the rather imprecise dating of finds, limiting the scope of considerations to the main taxonomic units of the Neolithic.

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THE SANDOMIERZ UPLAND IN THE RESEARCH OF JAN KOWALCZYK

In the 1960s, the Sandomierz Upland also became an object of interest on the part of Jan Kowalczyk, who undertook methodical research activities here, referred to as the "field survey" (Kowalczyk 1962). They consisted of a preliminary, partial survey of a single site or area, which was supposed *to initiate the outline of problems* and allowed the researcher a holistic view of the situation (Kowalczyk 1962: 301). According to J. Kowalczyk, this was a particularly important approach considering the contemporary state of research on the Neolithic.

An important issue was the selection of a suitable area. J. Kowalczyk believed the Sandomierz Upland and the areas adjacent to it to be one such area, *due to the concentration of very diverse soils and geomorphological elements* (Kowalczyk 1962: 302). An additional advantage were the *historical and geographical elements: the location at the intersection of an important Vistula water route with the Vistula and San water junction and the east-west land route* (Kowalczyk 1962: 302), as well as the proximity of flint raw material deposits.

Therefore, inspired by J. Kowalczyk (in 1962), surface prospecting along the lower Opatówka river and in the area of Annopol and Świeciechów, Kraśnik district was begun, and in the following years excavations of several key Neolithic sites were undertaken: Funnel Beaker culture settlements in Kamień Łukawski (Kempisty 1965) and in Zawichost-Podgórze (Balcer 1967), Sandomierz district and a flint mine in Świeciechów-Lasek, Kraśnik district (Balcer 1971). The results of this work, carried out over several seasons, are today the basis for many important findings. They also became the starting point for a broader reflection, including on the issue of "central settlements" in the Funnel Beaker culture, the issue of the relationship between the latter and the Globular Amphora culture, and the problem of the exploitation of flint raw materials by the communities of both cultures. These issues, signalled by J. Kowalczyk (1962: 304, 306), were analysed and discussed in later studies (cf. e.g. Tabaczyński 1970; Balcer 2002; Nowak 2009). Some details are also added by the studies on the Neolithic settlement of this region (Kowalewska-Marszałek 1992)[1].

SETTLEMENT OF THE FUNNEL BEAKER CULTURE

The Sandomierz Upland is an area of compact, intensive settlement of the Funnel Beaker culture, the sites of which constitutes over 40% of all known, culturally defined

[1] These studies are based on data concerning the whole area of the Sandomierz Upland in its geographic boundaries. The detailed data specified in the tables were obtained from an area systematically investigated (773 km^2), mainly during a systematic fieldwalking survey, that is thought to be representative of the whole Upland.

settlement points[2] from this region. The settlement network is made up of settlements, camps, workshops, cemeteries, graves, "hoards" (deposits) and undetermined traces of settlement (Table 1). The range of their occurrence covers the entire area of the Upland, but they are concentrated mainly in its central and, to a lesser extent – in the northern part; there too are the regions with the highest density of sites (Fig. 1a). The distribution of settlement points shows a division into three zones: northern, central and southern. The average density is almost 60 sites per 100 km^2, i.e. one site per 1.7 km^2 (Table 2); the largest is visible on the upper Gorzyczanka river (Fig. 2a). Larger concentrations also occur in the upper parts of the Kamionka river basin, the Opatówka river basin and some sections of the Vistula escarpment (in the vicinity of Złota, the area between the Pepper Mountains north of Sandomierz and Zawichost, Sandomierz district).

The results of the analysis of the spatial distribution of settlement points carried out using the Clark-Evans[3] test indicate a poorly agglomerated system (coefficient R = 0.87), close to random (Table 3). This situation differs from that observed in the loess highlands in the western parts of Lesser Poland, where the results obtained using the same test confirmed a rather regular, non-random points system (R = 1.499; Kruk 1980: 78).

The distribution of settlements which constitute slightly less than half of all settlement points of the discussed culture and are diversified in size is interesting[4]. They occur throughout the entire Upland, mainly in the central zone, and their more pronounced concentration is visible on the upper Kamionka river. In the central-western zone, as well as in the northern one, large settlements are most common, while in the central-eastern area medium-sized settlements predominate (Fig. 3a). The distribution of large and medium settlements exhibits the features of a regular system, in the case of medium settlements this regularity is even more pronounced (Table 3). This suggests the existence of a clearly defined "settlement pattern", largely independent of specific geographical and natural conditions. This is also confirmed by data on the relationships between the Funnel Beaker culture settlement network and individual elements of the natural environment (Kowalewska-Marszałek 2018: 315).

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[2] The term "settlement point" as defined by Kazimierz Godłowski (1964: 401); see also the comments of Janusz Kruk (1973: 30).

[3] Clark-Evans coefficient, allowing drawing conclusions about the nature of the system of points: random (R = 1), regular (R> 1) or agglomerated (R <1), (cf. Hodder and Orton 1976: 40).

[4] The division of settlements was adopted into small (up to 0.5 ha), medium (0.5–2 ha), large (2–5 ha) and very large (over 5 ha; Kowalewska-Marszałek 1992: 156).

Table 1. Sandomierz Upland – categories of settlement points of the Funnel Beaker and Globular Amphora cultures (according to Kowalewska-Marszałek 1992: Table 7).

Category of settlement points	Funnel Beaker culture	Funnel Beaker culture ?	Globular Amphora culture	Globular Amphora culture ?	Total
Settlement	197+ 31?	9+4?	33+14?	1?	289
Camp	10+3?	6	1	1	21
Settlement and grave	8	-	3	-	11
Workshop-type settlement	12	3	1	-	16
Cemetery	7	2	4	-	13
Grave	4	1	12	4	21
Trace of settlement	218	33	39	13	303
Others	17	5	9	2	33
Total	507	63	116	21	707

Table 2. Sandomierz Upland – the main features of the spatial distribution of settlement points of the Funnel Beaker and Globular Amphora cultures (according to Kowalewska-Marszałek 1992: Table 32).

Taxonomic unit	Number of settlement points *)	Number of settlement points per 10 km²		Average surface per 1 settlement point (in km²)
		Average	Maximum	
Funnel Beaker culture	455	5.9	11.7	1.7
Globular Amphora culture	102	1.3	2.8	7.6

*) for area systematically investigated (773 km²)

The so-called upland settlements are a special category. They are located in places of natural defensive value, but generally without traces of additional defensive constructions[5] that are known only from the settlement in Stryczowice (Uzarowicz-Chmielewska

[5] The aforementioned lack of defensive fortifications is not entirely certain due to the incomplete exploration of the sites and the research strategy used, involving excavations of the central rather than peripheral parts of settlements (Podkowińska 1950: 95 ff.; 1951/52: 201 ff.; 1962: 98; Kempisty 1965: 245 ff.; Balcer 1967: 290 ff.). Therefore, the existence of this type of construction cannot be definitely excluded.

Table 3. Sandomierz Upland – features of distribution of settlement points according to analysis with Clark-Evans' method (according to Kowalewska-Marszałek 1992: Tab. 33, 34).

Taxonomic unit	Region	Settlement points	R-coefficient (according to Clark-Evans test)	Distribution pattern
Funnel Beaker culture	Total area *)	All	0.87	Poorly agglomerated
		Medium-size settlements	2.02	Regular
		Large-size settlements	1.90	Regular
	Northern zone	All	1.28	Random / regular
	Central zone	All	0.84	Poorly agglomerated
	Southern zone	All	0.98	Random
Globular Amphora culture	Total area*)	All	0.88	Poorly agglomerated
	Zone A	All	0.83	Poorly agglomerated

*) area systematically investigated (773 km²)

1982; Uzarowicz-Chmielewska and Sałacińska 2013: 227). Other upland settlements[6] are only large or very large sites, usually characterised by a high intensity of use; all of them also revealed traces of earlier settlement. The smallest among them, with an area of about 2 ha, is the settlement in Nikisiałka Duża (Kupczyk 1970: 98).

Two upland settlements, of among the biggest in the Sandomierz Upland area, Ćmielów site 1 and the Pieczyska site in Zawichost-Podgórze, are also important production sites[7] related to the flint mines of the eastern Łysogóry region and large scale flint processing (Balcer 1975: 178 ff.; 2002: 147 ff.). The settlement in Ćmielów was focused on the processing of banded and Świeciechów flint, the settlement in Zawichost – on the processing of Świeciechów flint. The hypothesis about the participation of the inhabitants of the settlement in Ćmielów in specialised mining exploitation of banded flint and their relationships with the mines in Krzemionki Opatowskie, Ostrowiec Świętokrzyski district, has existed in the literature for a long time (Krukowski 1939: 84 ff.;

[6] Such as Ćmielów site 1 ("Gawroniec") and Grzegorzowice site Zagaje – Ostrowiec Świętokrzyski district, Nikisiałka Duża site 1 and Ptkanów site 1 – Opatów district, Gorzyczany site II, Kamień Łukawski site 1, Zawichost-Podgórze site Pieczyska – Sandomierz district.

[7] As defined by B. Balcer (1975: 178 ff.).

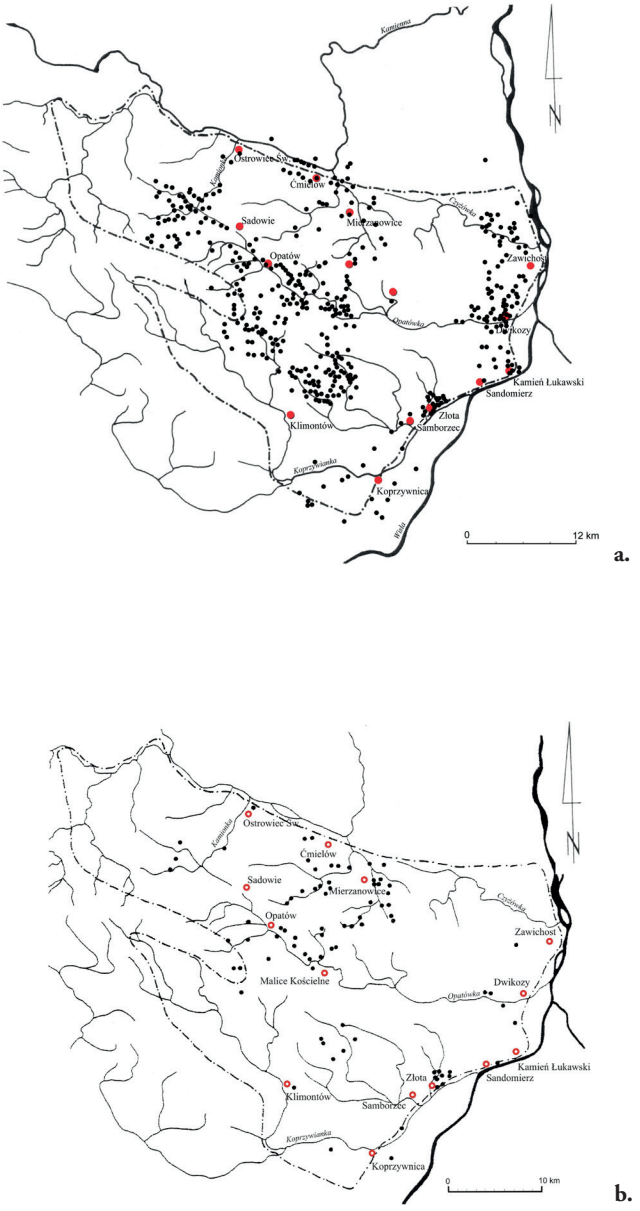


Fig. 1. Sandomierz Upland. Maps of distribution of settlement points of the Funnel Beaker culture (a) and of the Globular Amphora culture (b).

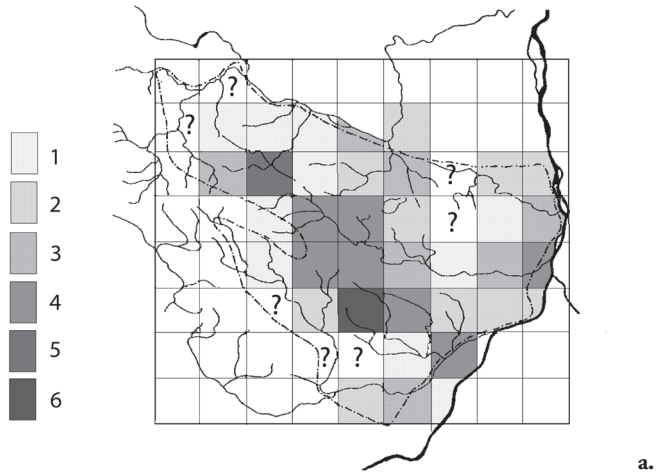


Fig. 2a. Sandomierz Upland. Distribution diagram of settlement points of the Funnel Beaker culture.

Legend: 1: <5 sites per 36 km²; 2: 5–10 sites per 36 km²; 3: 11–20 sites per 36 km²; 4: 21–30 sites per 36 km²; 5: 31–40 sites per 36 km²; 5: >40 sites per 36 km²; ?: no data available.

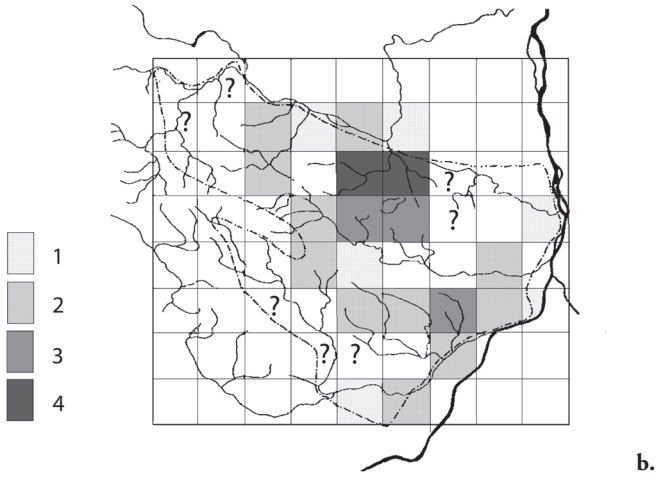
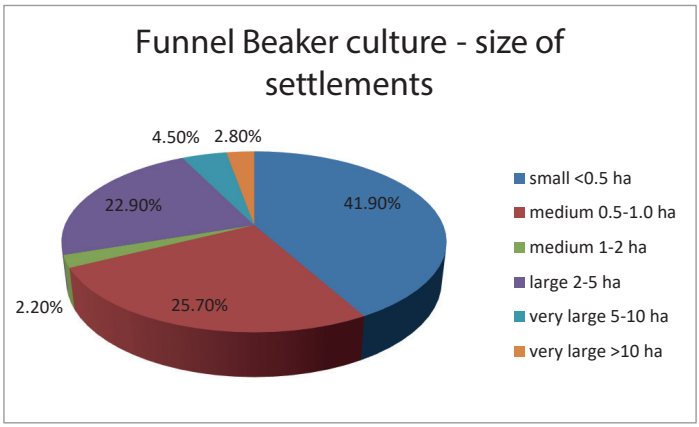
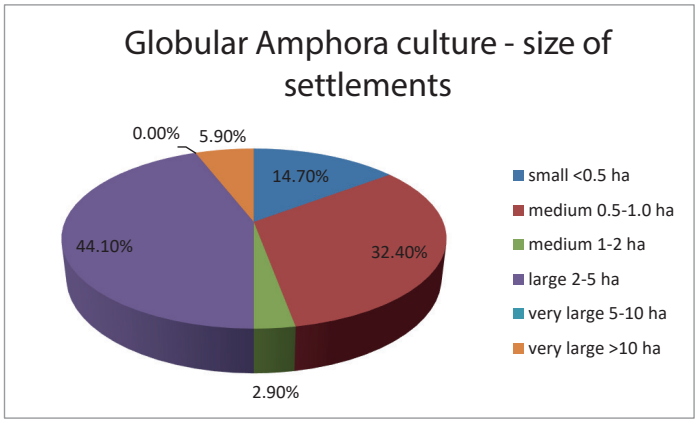


Fig. 2b. Sandomierz Upland. Distribution diagram of settlement points of the Globular Amphora culture.

Legend: 1: 1 site per 36 km²; 2: 2–5 sites per 36 km²; 3: 6–10 sites per 36 km²; 4: >10 sites per 36 km²; ?: no data available.



a.



b.

Fig. 3. Sandomierz Upland. Size structure of settlements of the Funnel Beaker culture (a) and of the Globular Amphora culture (b).

Podkowińska 1950: 132; Krzak 1961: 29 ff.; Balcer 1975: 180 ff.), though there was also some skepticism about it from, among others, J. Kowalczyk (Kowalczyk 1962: 306). However, the latest findings of Bogdan Balcer have allowed for *a much stronger grounding of this hypothesis* (Balcer 2002: 147). This researcher also showed that the *relationship between the settlement* [on Gawroniec hill] *and the exploitation of the deposits of the Świeciechów raw material was equally strong and even more important* (Balcer 2002: 147). In addition, in his opinion, *the settlement on Gawroniec can be described as the most*

specialised production centre in the field of mining and flint processing not only in the Świętokrzyski region, but within the even wider extent of the Funnel Beaker culture (Balcer 2002: 161).

In the light of settlement studies, the role of the upland settlements is not clear. Despite the basic common feature, which is their "defensive" location, they form a group quite diverse in size, nature, and – probably – in terms of the duration of functioning. The stability of many of them, which is largely the result of being located in favourable environmental conditions, undoubtedly had an impact on the more durable nature of connections with other elements of the settlement network. However, it seems that interpreting these sites as "outstanding regional centres" (Kowalczyk 1962: 304–306; Kruk 1980: 100) is only partially justified and concerns primarily their rank. On the other hand, it is hard to consider upland settlements as "central" points of the settlement network, due to their peripheral location in relation to the most intensive settlement zones, as well as due to the lack of particular concentrations of settlement points in their immediate surroundings. These settlements sometimes are even in some isolation from the others (e.g. Zawichost, Sandomierz district), while being elements of a network of large settlements regularly distributed throughout the Upland (Kowalewska-Marszałek 1992; 2012; 2018: Fig. 6).

The settlement network of the Funnel Beaker culture exhibits features that are fundamentally different from the previous "Danubian" settlement pattern (Kowalewska-Marszałek 2007). It is characterised by high uniformity (despite the abovementioned zonation), as well as preferring regions with similar environmental conditions (Kowalewska-Marszałek 2018: 320). Shifting the "centre of gravity" of the settlement to the northern and central regions of the discussed area could be justified by the connection of sites from this period with the exploitation and processing of flint raw materials: the banded and the Świeciechów flints outcrops of which are located in the north and northeast of the Upland (Schild 1971; Balcer 1975: 147). It cannot be excluded that more intensely used areas were not occupied (or occupied to a lesser extent) by settlements belonging to the late phases of the cultures of the Lengyel-Polgár cycle, with the very likely partial coexistence of both cultures in the area. On the other hand, a much larger (compared to the "Danubian" cycle) number of settlement points for the Funnel Beaker culture most likely has demographic justification (Kowalewska-Marszałek 1992: 251–252).

THE SETTLEMENT NETWORK OF THE GLOBULAR AMPHORA CULTURE

The settlement network of the Globular Amphora culture consists of over 100 settlement points, among which settlements predominate; camps, workshops, cemeteries, individual graves and traces of settlement are also known (Table 1). Their range

of compact occurrence is limited to the northwestern part of the Sandomierz Upland, from the Kamionka river in the west to the Krzczonowianka river (formerly: Gierczanka river) in the east and the tributaries of the upper and middle Opatówka in the south; small concentrations of sites are also visible on the upper Gorzyczanka and at the Polanówka river in the area of Złota, Sandomierz district. In the eastern and southern parts of the Upland, only single sites of this culture are encountered. They are found in the vicinity of Winiary, Dwikozy and Koprzywnica, Sandomierz district (Fig. 1b). Such a picture, it seems, only to a small extent results from the state of exploration of the area in question, and the lack of sites in its eastern and southern parts (apart from the few exceptions mentioned above) seems to be unquestionable.

Settlement points belonging to the Globular Amphora culture occur together in an area of about 648 km^2, which is little more than half of the entire area of the Upland itself. However, the area of their maximum density covers only 180 km^2 and coincides with the abovementioned dense range of their occurrence in the watercourse area of: the Przepaść river (formerly: Obręczówka), Krzczonowianka and middle part of Opatówka river (Fig. 2b). This situation is only slightly reminiscent of that observed in the Funnel Beaker culture, where settlement points were connected primarily with the middle part of the Upland.

Cluster analysis based on the shortest distance dendrite (Chojnicki 1977: 107–111), when rejecting distances exceeding 3 km, allows us to distinguish two main zones in the discussed area (Kowalewska-Marszałek 1992: 253):

A – a "central" – macro-cluster along the Krzczonowianka and Przepaść rivers;

B – "peripheral" – covering remaining areas.

The average density for the systematically examined area is 13 sites per 100 km^2 (one site per 7.6 km^2), therefore it is more than four times smaller than in the case of the Funnel Beaker culture (Table 2).

The analysis of the spatial arrangement of settlement points indicates an agglomerated distribution model, with a moderate degree of concentration, similar to that of the Funnel Beaker culture (Table 3). This applies to both the entire area of sites occurrence and the zone (the macro-cluster) A. Within the latter, quite an even distribution of sites throughout the area is observed, except for the central part (this lack may, however, be due to deficiencies in site discovery). The medium density of settlement points (2.8 points per 10 km^2) is more than twice higher than the average; distances between the sites are small: from 0.3 to 1.4 km, most often 0.6–0.9 km. The eastern border of this zone may, as has been mentioned, undergo some corrections as a result of future studies, while the remaining ones can be determined to a degree that does not raise major doubts.

The "island" character of settlement in zone B also seems to correspond to the real situation. Here small areas of concentrations of sites (and in the southern part – individual sites) are separated by strips of land at least 3 km wide. However, the density

of sites and the distance between them within individual concentration areas do not differ significantly from those observed in zone A.

The 33 clusters identified during the analysis[8] have from 2 to 6 sites (most often they are pairs of settlement points), covering an area from 0.4 to 12.5 km^2 (in zone A: 2–4 sites in the area from 0.4 to 2.2 km^2), with distances between sites from 0.2 to 2.9 km (average 1.25 km). Most often one meets linear arrangements of settlement points. The concentration regions in zone B comprise from 1 to 3 clusters (Kowalewska-Marszałek 1992: 254). The number of sites in individual clusters – as well as the average area of these clusters – is therefore smaller than in the Funnel Beaker culture (Table 4). On the other hand, the distances between settlement points within clusters are similar to those in the northern zone of Funnel Beaker culture.

In one of the clusters in the southern part of the Upland, a specific configuration is visible: settlement points at even, relatively large intervals of 2.5–3.0 km, stretched out in a "line". A thorough examination of the area excludes the randomness of such a system, it also seems to contradict the regular distribution of sites. A similar situation is to be found repeated on the upper Opatówka river (similar distances between the sites with a slightly different arrangement), as well as along the Kamionka river.

Most of the settlements of the Globular Amphora culture (Fig. 2b) are associated with zone A, and sites of a different character are encountered there exceptionally. In zone B, the distribution of settlements and settlement points of other kinds is more even: 1–2 settlements per cluster. Large settlements (Fig. 3b) usually occur individually, with only two clusters in zone A are connected two large settlements (the cluster of Wojnowice, Ostrowiec Świętokrzyski district, and that of Stodoły, Opatów district).

Cemeteries occurred in zone A, as well as in two clusters of zone B (in the area of Sandomierz and Złota, Sandomierz district), in the immediate vicinity of settlements. In contrast, individual graves are spread throughout the entire area of the occurrence of the Globular Amphora culture, and their location near settlements is not a rule (e.g. grave in Rzeczyca Mokra site 1, Sandomierz district, located 2.5 km from the nearest known settlement).

The settlement system of the Globular Amphora culture is a phenomenon quite different from that of the Funnel Beaker culture. One of the few elements common to both cultures is the heterogeneous character of the settlement network. On the other hand, the arrangement of sites, the way they are combined into complexes, and – probably – the way they had functioned, show many differences.

It seems that the compact settlement zone (A), consisting mainly of settlements occurring in pairs or in ternary systems constituted a spatially developed micro- or mesoregion (Kurnatowski 1973: 18), utilised with similar intensity throughout the duration of the Globular Amphora culture and showing characteristics of a stable

[8] Using the "nearest neighbour" method (Hodder and Orton 1976: 38–42; Kobyliński 1987: 26–29).

Table 4. Sandomierz Upland – characteristics of clusters in individual settlement zones of the Funnel Beaker and Globular Amphora cultures (according to Kowalewska-Marszałek 1992: Table 35).

Taxonomic unit	Region	Number of clusters	Number of settlement points in the cluster (min./max.)	Average number of settlement points in the cluster	Average surface area of the cluster (in km²)	Average distance among settlement points within the cluster (in km)
Funnel Beaker culture	Northern zone	17	2-6	2.94	1.59	0.83
	Central-western zone	67	2-8	3.53	0.81	0.50
	Central-eastern zone	35	2-6	3.53	1.02	0.50
	Southern zone	8	2-5	3.38	1.99	1.16
Globular Amphora culture	Zone A	19	2-4	2.53	0.93	0.75

territorial organization (large settlements, cemeteries). Therefore, individual groups of sites would rather correspond to the subsequent stages of the functioning of this large system, although connections of functional character cannot be ruled out. On the other hand, the concentration of sites in zone B seems to consist mainly of small settlement complexes (clusters in the area of Usarzów, Opatów district, Sandomierz, Złota and Kichary Nowe – Sandomierz district). On the other hand, linear system of sites noted in the south-eastern and north-western parts of the Upland may constitute traces of occasional penetration into areas not permanently inhabited by the population of the Globular Amphora culture. Alternatively, they could be "staging points" on trade routes, and this seems more likely due to the regularity of their arrangement (Kowalewska-Marszałek 1992: 258).

SUMMARY

The analysis of the spread of settlement points of both analysed taxonomic units allows us to state the clear differences between them. Sites of the Funnel Beaker culture occur throughout the entire study area, with a tendency to form discret clusters in the

central and eastern parts of the region, while the Globular Amphora culture sites are mainly in its northern part. There is also a difference in the spread of sites of both cultures in relation to earlier "Danubian" cultures, whose settlement points were concentrated in the south-eastern and eastern parts of the Upland (in the Vistula zone), with a complete absence on the north-eastern edges (Kowalewska-Marszałek 2007). This is probably due to the disappearance in this period of the earlier southern direction of far-reaching contacts and impacts.

The settlement network transformed, from a relatively homogeneous one in the early Neolithic, into a heterogeneous form as a result of the emergence in the Funnel Beaker culture of new categories of sites: several types of settlements, separate cemeteries and flint workshops.

Along with the transformations of settlement structures there was a shift in the nature of their links with the natural environment. Initially, the main role was played by the Vistula and its tributaries in the southern part of the Upland; beginning from the time of the Funnel Beaker culture, the watercourses in its northern part were gaining in importance. Two special trends are visible in the location of settlements relative to soils: in the Funnel Beaker culture we observe the desire to maximise the use of all soil types,, in the arrangement related to the Globular Amphora culture, there is more of a tendency to closely link the settlements to selected soil types and to the areas of their "mosaic"-like occurrence. On the other hand, there is a tendency to locate settlements, especially large ones, in such a way that their "closer" exploitation territories (Higgs and Vita-Finzi 1972; Jarman 1972; see also Kowalewska-Marszałek 1988) extend over several different habitat zones. In this way, efforts were probably made to maximise access to a variety of natural resources.

The analysed period seems to be a time of a fundamental change in the nature of the settlement network, consisting of changes in the integral treatment of space (Kowalewska-Marszałek 1992: 296–297). This is reflected in the way the settlements are developed, and, to a greater extent, in the structure of the regional settlement network. The latter exhibits features of planned territorial organization and spacial stabilization, visible above all in the increasing regularity of the distribution of settlements, especially large and medium-sized ones, throughout the entire culture area of the Funnel Beaker culture, as well as in the isolation of additional permanent points in the form of cemeteries, generally used on a continuous basis until the early Bronze Age[9].

The intensive exploitation of banded flint in the Late Stone Age undoubtedly required the existence of a settlement base in close proximity to the mines of this raw material. There is a lot of evidence that this role was primarily played by the Sandomierz

[9] A "functional" treatment of collective graves – also megalithic tombs – as fixed points of space and territory markers in the Neolithic European communities with the dispersed settlement model is one of the currently accepted possibilities of their interpretation (e.g. Renfrew and Bahn 1991: 428).

Upland, which comprises the natural context for the functioning of the flint mines located in the Krzemionki area, Ostrowiec Świętokrzyski district, especially in the Middle and Late Neolithic period and in the early Bronze Age. Its crucial role in this context has often been indicated in the literature on the subject (e.g. Krukowski 1939: 84–97; Wiślański 1969: 246–248; Balcer 1975: 247; Kruk 1980: 105). A detailed analysis of middle and late Neolithic settlements fully confirms the thesis about the significant role of the Sandomierz Upland as a settlement base for the banded flint mines in the Krzemionki region. Considering all the analysed features of the settlement network in this area, it can be stated that the relationship with banded flint mines is more pronounced in the case of the Globular Amphora culture. This is evidenced above all by the clear concentration of sites of this culture in the northern part of the Upland, in the immediate vicinity of the raw material outcrops, in the context of an absence of similar concentrations in other regions. Such a clear accumulation of settlement sites is lacking in the Funnel Beaker culture, while large settlements of this culture (e.g. Ćmielów-Gawroniec or Stryczowice site 1, Ostrowiec Świętokrzyski district) show only a partial connection with the processing of banded flint (Balcer 2002: 147; Sałaciński 2013: 257 ff.).

The macro-cluster of the Globular Amphora culture sites in zone A was undoubtedly primarily associated with the exploitation of banded flint. The concentration of settlements testified there is yet another argument to support the hypothesis about the intensive exploitation of mines in the Krzemionki area by the communities of this culture and the participation of these human groups in the exchange on a large, supra-regional scale (Balcer and Kowalski 1978: 137; Balcer 1983: 208, 223–226; 2002: 20; Borkowski 1995: 15).

Translated by Andrzej Leligdowicz

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Research on the Lublin-Volhynian Culture

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The text summarises the field research of Jan Kowalczyk on the Lublin-Volhynian culture, and presents some conclusions resulting from the confrontation of his discoveries on the Jaszczów 5 and Gródek 1C sites with the current state of knowledge about this culture.

KEY-WORDS: Jaszczów, Gródek, Lublin-Volhynian culture, Jan Kowalczyk.

The later Danubian cultures were not in the mainstream of Jan Kowalczyk's research interests. Nevertheless, during his field activity, he was in contact with the remains of settlements of these cultural units. This applies primarily to the "Linear Painted Pottery culture", as – in accordance to the nomenclature adopted at the time – he called a group currently known as the Lublin-Volhynian culture.

In fact, only two sites on which Jan Kowalczyk discovered the remains of this culture settlement can be indicated. The first one is Jaszczów, Łęczna district, where in 1952 together with Zygmunt Ślusarski he carried out surface surveys. In deflation niche of the dune located on the right bank of the Wieprz River, they discovered a destroyed grave (Kowalczyk 1954/55), in which a group of vessels remained (Fig. 1). It was the second similarly damaged burial feature on this site, beside one discovered in 1949 by Stefan Nosek (1949). There were seven vessels (Fig. 2), four Cretaceous flint trapezes and three erratic flint flakes in the cluster.

This trivial collection of vessels provided important data about flint production of the Lublin-Volhynian culture and its cultural relations, under which the microlithic trend was developed. Namely, three of four trapezoidal insets were made by means of a Mesolithic microburin technique. The knowledge of this technique in the population of Lublin-Volhynian culture was confirmed not only by the discoveries of the trapezoidal insets, but also by microburins – production wastes (Wąwolnica, Puławy district, site 6 – Zakościelna 1996: 71, Tab. XXXVI: 21).

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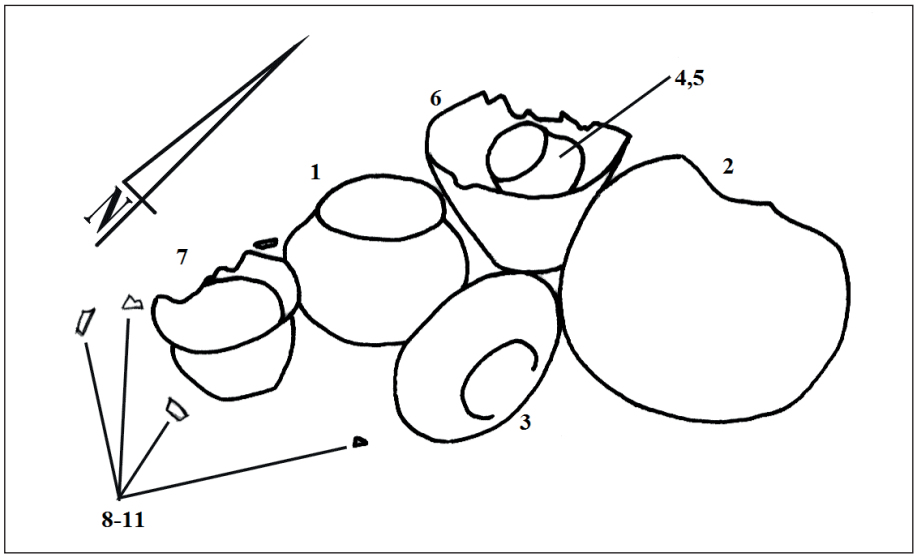

Fig. 1. Jaszczów, site 5. Vessel cluster plan – remnants of a grave (according to Kowalczyk 1954/55).

Obvious Mesolithic references led to the hypothesis of contacts with the epigones of previous era (among others: Zakościelna 1985), which – given the rather intense penetration of the Lublin Upland foreland by the Lublin-Volhynian communities (the manifestations of this are, among other things, graves discovered on the dune in Jaszczów) – seems to be fully possible. However, in formal terms, the specimens from Jaszczów – very low – do not fit in the typology of trapezoid Mesolithic insets and such items are not known from the inventories of this period. On the other hand, their presence is recorded in the para-Neolithic sites of forest zone groups, among others in Sośnia, Grajewo district (Więckowska and Kempisty 1970, Tab. IX: 15, 20, 21) and – what is significant – next to triangular projectile points made by trough-like retouch (ibid. Tab. IX: 24–28), which have strict analogies in the Lublin-Volhynian culture inventories (Zakościelna 1996: Fig. 9). Proof of relationships with the para-Neolithic groups of the forest zone was also provided by the research in Bronocice and Iżykowice, Pińczów district, where "comb-impressed" ceramics were found in the settlement features of the Lublin-Volhynian culture (Kruk and Milisauskas 1985: 64, 65). On the basis of the flint-work, irrefutable evidence was obtained during the research on the cemetery in Książnice, Busko Zdrój district, mainly in grave No. 4, in the inventory of which low trapezoids are accompanied by Sośnia-type projectile points (Wilk 2004, Fig. 7: 12, 16–18; Zakościelna 2006: 284).

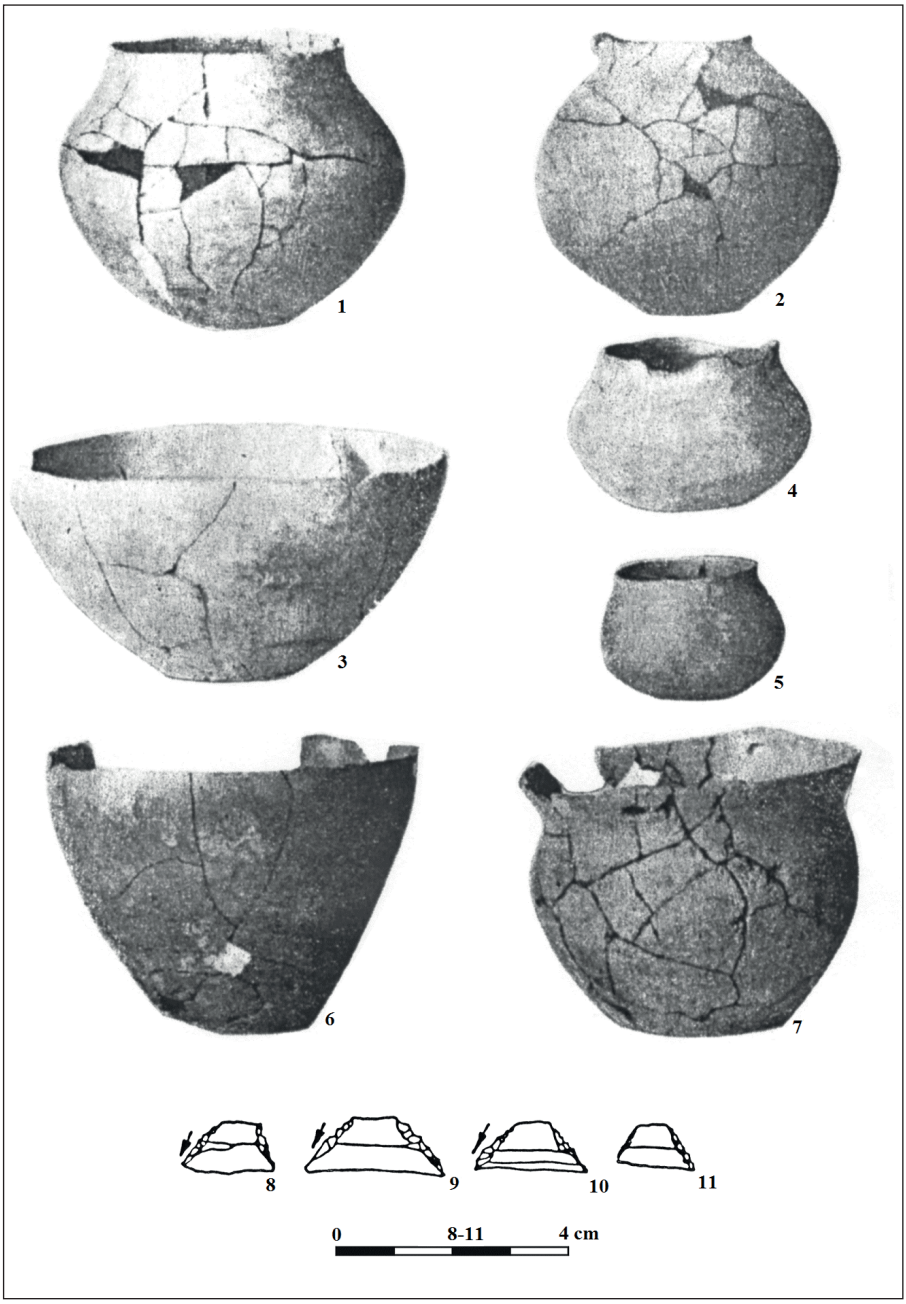

Fig. 2. Jaszczów, site 5. Grave inventory (according to Kowalczyk 1954/55 and Zakościelna 1985).

In the light of the present state of research, it can be said, that the issue of direct contacts between the population of Lublin-Volhynian culture and the para-Neolithic groups of the forest zone, as a result of which the microlithic trend of flint processing developed in the Lublin-Volhynian culture, is beyond discussion, and the materials obtained by Jan Kowalczyk in Jaszczów were the first tangible evidence of these relationships.

Jan Kowalczyk also came across the remnants of the Lublin-Volhynian settlement at the site 1C "Horodysko" in Gródek, Hrubieszów district. His research was a continuation of the excavation work undertaken there by Konrad Jażdżewski in 1952 on behalf of the State Archaeological Museum and the "Research Commission on the Cherven Cities (or Grods)" (Jażdżewski 1958; Poklewski 1958). During four research seasons (1954–1957), he explored 15.6 hectares of area in the central loess plateau on which the site is located (Fig. 3, 4), and also identified its northern and southern extents by test excavations (Fig. 5). This excavation campaign resulted in the discovery of the exceptionally rich remains of the Funnel Beaker culture settlement (several dozen settlement features, tens of thousands of artefacts) and relics of a fortified settlement in the form of a fragment of a ditch (as it turned out in the 1980s originating from the Lublin-Volhynian culture – Jastrzębski 1985: 5–7). The results of these studies were reported by Jan Kowalczyk on a regular basis through extensive reports in the

Fig. 3. Grodek, site 1C. Aerial view of the site. Photo: S. Orłowski.

Fig. 4. Grodek, site 1C. A view of the site from the west. Photo: A. Zakościelna.

Wiadomości Archeologiczne (1956; 1957a; 1957b; 1958). In addition to the presentation of the excavation results, he drew attention to several important general issues, including the relation with the Tripolye culture, whose numerous imports, as well as examples of pottery imitations and also Tripolye influence on the form of residential constructions were confirmed by his research. A full synthesis of these excavations was published at the end of the 1980s (Gumiński 1989).

Thanks to Konrad Jażdżewski (1958) and Tadeusz Poklewski (1958) at first, and then to Jan Kowalczyk, the site 1C in Gródek has permanently entered into the scientific literature as so-called upland settlement of the Funnel Beaker culture, although the history of settling of the Horodysko site – a naturally defensive plateau standing out in the landscape – is older and much longer (Kokowski 1993). The unique wealth of settlement residues attracted the attention of the researchers specialized in various eras, which has resulted in several excavation campaigns aimed at various research or conservation problems. Very interesting discoveries, including Lublin-Volhynian culture funerary features, were made by farmers during field work. In the majority of cases they were later excavated by archaeologists (for example: Kokowski and Ściborowie 1994). Attentions should be drawn to two expeditions that have brought the most information about the settlement of this place by the Lublin-Volhynian culture, preceding the settlement of Funnel Beaker culture.

Thirty years after Jan Kowalczyk's excavations, Sławomir Jastrzębski made an attempt to explain the cultural attribution and course of the ditch, the fragment of which was discovered in the central part of the site in the 1950s (Kowalczyk 1975b: 305). It turned out to be a part of the Lublin-Volhynian cultural settlement, as indicated by both

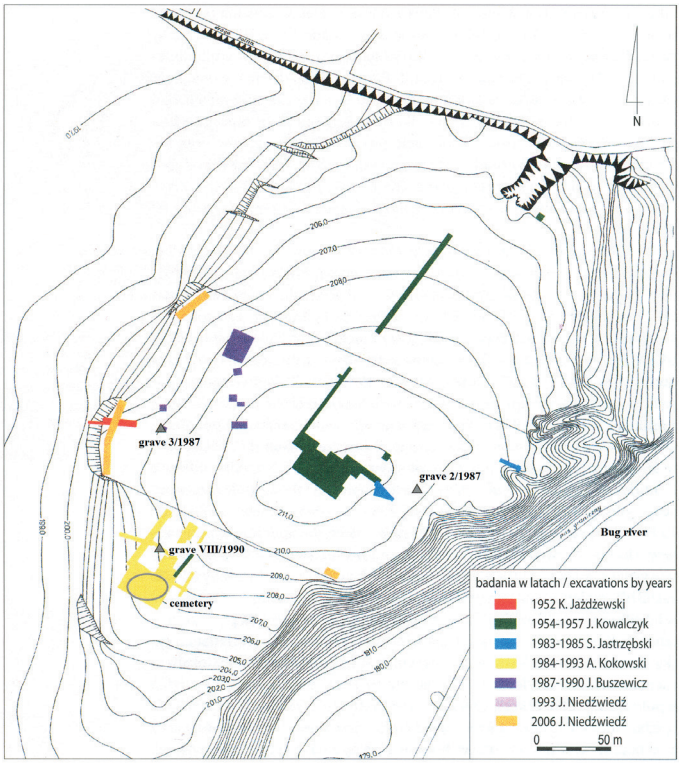

Fig. 5. Gródek, site 1C. Location of the excavations in particular research seasons and location of the single graves and cemeteries of the Lublin-Volhynian culture (according to Komisarczuk 2008 and Zakościelna 2010).

the materials in the fill and the radiocarbon dating of organic materials lying in the bottom of the feature (Jastrzębski 1991: Tab. 1; Zawiślak 2013: 115 and Tab. 2). A single settlement pit and quite a large redeposited assemblage of ceramic material of this culture indicated the functioning of the settlement in the classical and late phase (Bronicki *et al.* 2004: 104).

In 1984-1990, a huge excavation was conducted by Andrzej Kokowski in the southern part of the site 1C (among others: 1989, 1993). The research, aimed at exploring the Roman period cemeteries provided important discoveries related to the Eneolithic phase of Horodysko, including the Lublin-Volhynian culture settlement. A cemetery of six graves (Fig. 6), badly damaged by the Funnel Beaker culture settlement was recorded (Zakościelna 2010: 52–53).

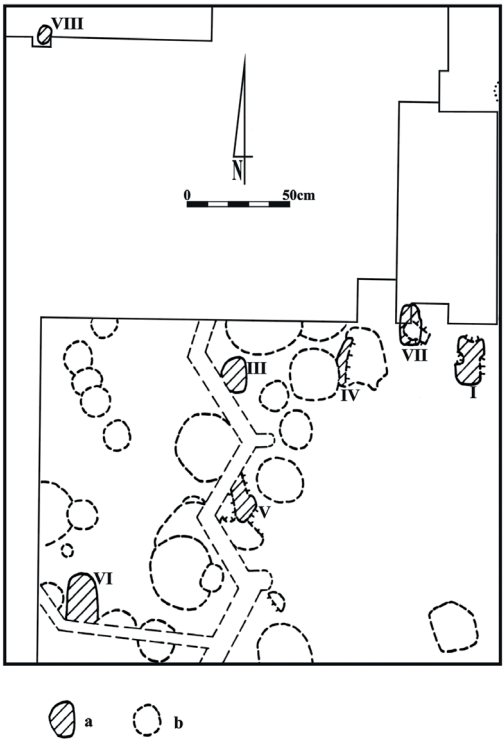

Fig. 6. Gródek, site 1C. Cemetery of the Lublin-Volhynian culture: a – graves; b – settlement pits of the Funnel Beaker culture (according to Kokowski 1989 and Zakościelna 2010).

After more than 60 years since Jan Kowalczyk's excavations at site 1C in Gródek, the history of its settlement has been significantly enriched, although it is difficult to say that we have a comprehensive picture of it. As for the Eneolithic settlement sequence, the use of the plateau situated above the Bug valley was started by the Lublin--Volhynian culture in the classical phase, with a settlement surrounded by a ditch, which functioned also in the late phase (Bronicki *et al.* 2004). The older phase of this settlement is connected with five human graves located in various parts of the site, while the graveyard, a bit remote from the settlement, was created in the late phase (Zakościelna 2010: 45–46, 52–53). The population of the Lublin-Volhynian culture left Horodysko no later than around 3650 BC, then the representatives of the Funnel Beaker culture arrived, and covered the site with a very intense settlement (phase Gródek I: 3650–3500 BC – Bronicki *et al.* 2004: 104–108). It seems to have been a hostile takeover of the area, the settlement pits of this culture destroyed graves of the Lublin-Volhynian culture cemetery, which probably were still visible on the surface (Fig. 6).

In the introduction, I mentioned that Jan Kowalczyk's research interests did not focus on the Later Danubian cultures. The above-mentioned examples of his discoveries, however, significantly contributed to explaining the origins of the microlithic trend in the Lublin-Volhynian culture flint processing and to supplementing the history of settlement of one of the most important prehistoric sites at in this part of the Vistula and Bug watershed.

Translated by Tomasz Myśliwiec

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The Funnel Beaker Culture in the Lublin Region in the Light of the Excavations and Publications of Jan Kowalczyk

Jolanta Nogaj-Chachaj[a]

The article discusses the contribution of Jan Kowalczyk to the study of the Funnel Beaker culture. The paper presents his achievements in field research on settlements and funerary sites in Central and Eastern Poland (cemeteries and settlements on the Nałęczów Plateau, settlement in Gródek in the Hrubieszów Basin) and thoughts on the methodology of searching and exploration of the Neolithic graves. The most important publications of this author were also recalled. The results of his work are placed in the context of the present state of research.

KEY-WORDS: Neolithic, Funnel Beaker culture, funerary rites, settlements, chronology, research methods.

Archaeological research conducted in the Lublin region in the first years after World War II abounded in discoveries related to the Later Stone Age. It was then that a young student and adept in archaeology, Jan Kowalczyk, came across the research issues concerning the Funnel Beaker culture (hereinafter: FBC) and Globular Amphora culture (hereinafter: GAC), during the rescue excavations of the Neolithic graves and cemeteries of Nałęczów Plateau. Later, studies on these two specific Neolithic cultures dominated Jan Kowalczyk's scientific interests.

Active participation in field work on prehistoric cemeteries in Stok and Las Stocki in the Puławy district[1], brought the researcher the necessary experience and knowledge used during writing his doctoral thesis (Kowalczyk 1951) entitled: *Obrządek pogrzebowy w młodszej epoce kamienia na ziemiach Polski* [*The funerary rite in the Late Stone Age in Poland*] under the guidance of professor Stefan Nosek. The thesis, defended in 1951, was not published for political reasons, and is currently available only as a summary (Nosek 1951; Zakościelna and Gurba 2007: 384). In 1949–1954, docent Jan Kowalczyk

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[1] This research was conducted under the direction of Stefan Nosek, together with Leszek Gajewski, Jan Gurba and Zygmunt Ślusarski (see Gajewski 1949: 3).

Fig. 1. Location of the FBC and GAC sites in the vicinity of Klementowice, Puławy district. According to Nogaj-Chachaj. Graphic design: S. Żorawski.

participated in, or conducted independent, excavations at Neolithic sites in Stok, Las Stocki and Klementowice II, Puławy district. In 1954–1957 he was working on the excavation of the FBC settlement in Gródek,[2] Hrubieszów district, and in 1969–1970 in the banded flint mine in Krzemionki Opatowskie[3] (Zakościelna and Gurba 2007: 385). The researcher presented his ideas on the phenomena and processes observed during research in numerous reports and articles, and – in a popularized version – in

[2] In the literature, the incorrect name of the town was recorded – "Gródek Nadbużny".

[3] An archaeological reserve located between the villages of Sudół and Magonie in the Ostrowiec Świętokrzyski district.

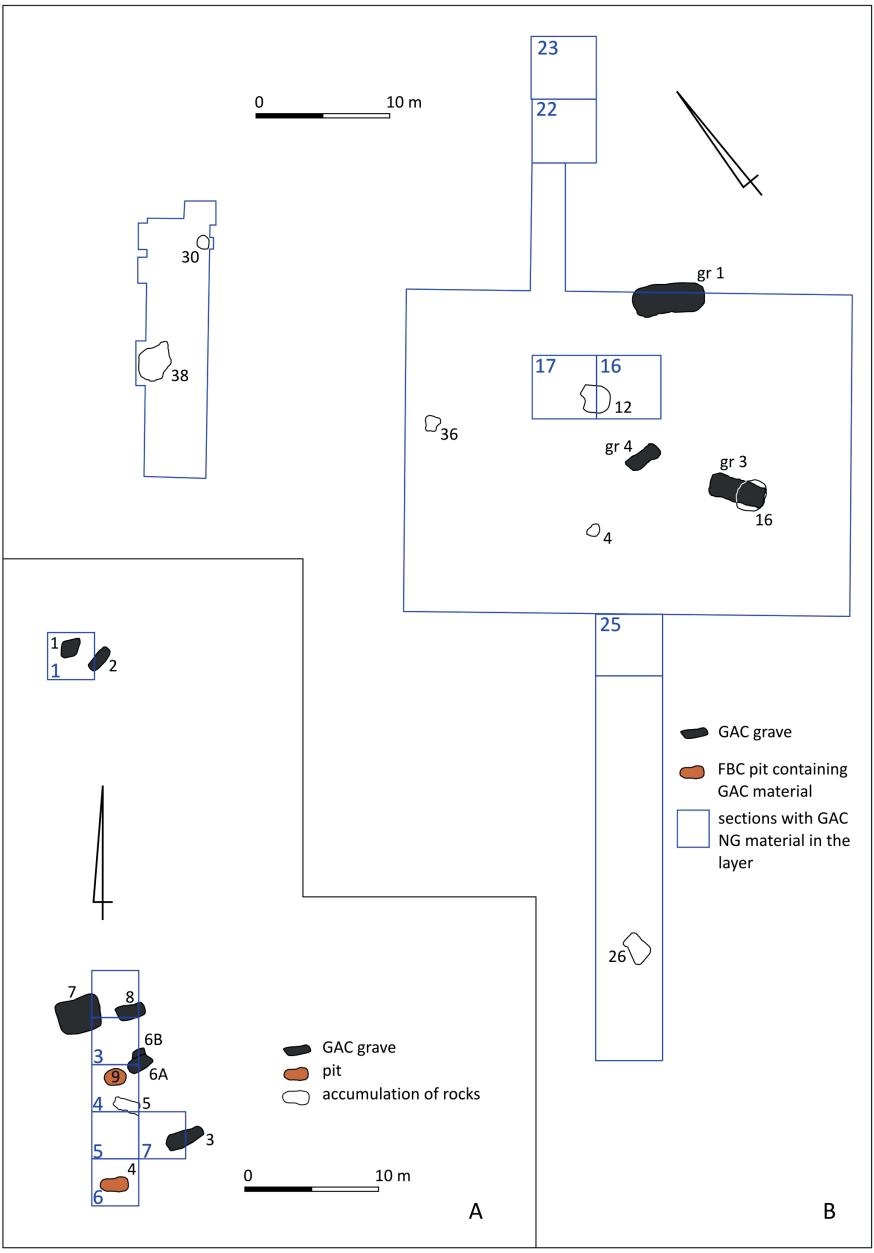

Fig. 2. Layout of GAC cemeteries at sites II (B) and IV (D) in Klementowice. According to Kowalczyk 1957; Halicki 1970. Graphic design: S. Żorawski.

a little-forgotten book entitled *Zmierzch epoki kamienia* [*The Twilight of the Stone Age*], published in 1971.

Analysing the works of Jan Kowalczyk concerning the research on the FBC, it can be said that they focused on the recording of this settlements, graves and cemeteries of this culture, as well as on the problems of chronology, genesis and applied research methods.

Jan Kowalczyk was one of a group of researchers who conducted field work both on medium-sized camps, as well as on the large FBC settlements in Poland. He carried out the first excavation research on this culture settlement at the site Klementowice II. An area of 1303 m^2 was excavated, 43 pits connected with economic activities and three poorly preserved graves of the FBC were examined, and the results were published in the journals *Materiały Starożytne* (Kowalczyk 1957c) and in *Wiadomości Archeologiczne* (Halicki 1970). The author intended to use the results of the research for comparative analysis of various Neolithic types of settlement features of loess areas (Kowalczyk 1957c: 176).[4] The pits left behind by the activities of the FBC population, were irregularly spaced across the area of the site and were of different sizes. The analysis of their layout enabled Janusz Kruk to postulate the hypothesis that the layout of the features represents the sites of above-ground constructions with outdoor fire pits (Kruk 1980: 99, Fig. 14; Kruk and Milisauskas 1999: 136, Fig. 38). Site II in Klementowice is regarded in contemporary archaeological literature as an example of a small, partially excavated, settlement of the FBC south-eastern group, located on the edge of the loess plateau, in the centre of which Neolithic farmland could have been located. Presumably, it was a part of a large local cluster, with a complex structure and extensive economic functions (Kruk and Milisauskas 1999: 119, 137). The site in Klementowice was also the first one in the Nałęczów Plateau and the Lublin region where simultaneous occurrence of both funerary and settlement features of the FBC was recorded (Kowalczyk 1957: 175).

Currently, small Klementowice type settlements are assigned to the second phase of FBC development (Bronocice II), which corresponds to the years 3640–2480 BC (Kruk and Milisauskas 1999: 135). Research carried out in 1987–2002 on the settlement and cemeteries in Karmanowice, located 2–3 km south of Klementowice, revealed that both sites existed at a similar time: 3700–2900 BC (Nogaj-Chachaj 1999: 27; 2004: 66).

In 1954–1957, on behalf of the State Archaeological Museum, Jan Kowalczyk continued, the study of the FBC settlement in Gródek, initiated by Konrad Jażdżewski (Jażdżewski 1958: 279; Gumiński 1989: 10). *In excavations with a total area of 15.6 ares, he discovered a particularly rich central part of the settlement, and in the surveys captured*

[4] Additionally, as part of the rescue works on this site, he excavated four graves of the Globular Amphora culture (Bronicki 2016: 80).

its northern and southern range. In published reports from four subsequent research seasons, he raised a number of new issues (Gumiński 1989: 10). Research on this extensive and unique site completely absorbed the researcher's time. In the context of this work, there appeared the problem of explaining the existence of both such large settlements and *small semi-permanent encampments*, as the excavator of Klementowice II called the site in one of the excavation reports (Kowalczyk 1957: 50). He stated: *Perhaps, in the case of Gródek we are dealing with a "home" settlement, near which there are small camps related to livestock farming, but perhaps – the camp in Klementowice, testifying to the low life expectancy, is a reflection of the fall of the Funnel Baker culture at the end of the Neolithic period. Both hypotheses have a chance of probability, but only further research can provide more reliable data in this area* (Kowalczyk 1957a: 50). In his subsequent works, J. Kowalczyk pointed out the strong influences of the Tripolye culture, which are noticeable both in the form of technological imitation of ceramic products and in the presence of vessels directly imported from the territory of Tripolye culture (Kowalczyk 1957a: 48; 1957b: 304; Gumiński 1989: 10). In addition, he emphasized the high level of "workmanship" of artefacts discovered in this site. He also attempted to differentiate the chronology of settlement, suggesting the possibility of separating two phases of development (Kowalczyk 1956: 46). These theses were presented as reports on current field research, published in *Wiadomości Archeologiczne* (Kowalczyk 1956; 1957a; 1957b; 1957c; 1958). They also contained descriptions of the most interesting features and finds. In each of these reports, he systematically interpreted the nature of the excavated features and artefacts. In discussions, he rejected the possibility of interpreting the settlement in Gródek as a form of kraal (Kowalczyk 1958: 318). In the final phase of research on the site, he did not confirm the late age of the settlement suggested in earlier studies – which seemed to contradict a small amount of cord ornament on the FBC ceramics (Kowalczyk 1957b: 304).

From the beginning of the work in Gródek, the researcher was looking for the reasons for the collapse of a FBC settlement centre that had been so dynamically developing. He saw the cause for the abandonment in a fire and sudden destruction of the settlement. The destruction of the Gródek settlement – as he claimed – could have occurred as a result of an inter-tribal clash or the invasion of foreign tribes (Kowalczyk 1957a: 48; 1957b: 304). He realized that the proposed hypothesis required further, detailed research, so he considered it as an attempt to historically treat the archaeological problems (Kowalczyk 1957a: 48). In a later work he wrote: *In the Lublin region, stratigraphic data indicate that the first alien population that came into the area of Funnel Beaker Culture domination, were tribes of the Globular Amphora culture, so the fall of the settlement in Gródek should be related to them* (Kowalczyk 1958: 319). Perhaps a deep conviction about that conflict arose from a very good knowledge of the GAC funeral rites and the awareness of different ways of living for the population of both cultures. It is worth noting that – contrary to the views of K. Jażdżewski – he shifted the dating

of the intensive FBC settlement development to an earlier period (Kadrow 2015: 203). The crowning argument for the early chronology of the Gródek settlement was (the erroneous, as it turned out later, cf. Breuning 1987) radiocarbon data obtained for pit 13 (Kowalczyk 1968: 368; cf. next).

The research conducted in the 1990s, revealed the presence of a Lublin-Volhynian Culture settlement in Gródek, preceding that of the FBC. A similar sequence of cultural succession was also found in the Zimne settlement, Volodimir Volins'kij region (Bronicki *et al.* 2004) and at Bronocice, Pińczów district (Kruk and Milisauskas 1999; Bronicki *et al.* 2004: 121, Fig. 4; Kadrow 2015: 203).

All these observations and results of fieldwork became the main source for creating the concept of the genesis of the FBC in Poland. These views were presented in a synthetic work devoted to the Neolithic in Polish lands, published under the editorship of Tadeusz Wiślański (Kowalczyk: 1970). The author presents his vision of the FBC genesis against the widely discussed, popular hypotheses explaining the cause of this cultural phenomenon: *As has been said above, this culture very probably emerged on the basis of the local Mesolithic, in the 4th Millennium B.C. Judging from the C-14 figures, it reached its peak in the 3rd Millennium B.C. (vide Gródek Nadbużny, 3100±160 BC), and probability is indicated by the carbon-datings obtained for the Globular Amphora culture in the Lublin district* […] (Kowalczyk 1970: 177).

In the literature on the subject, Jan Kowalczyk is widely known as a researcher of the GAC graves and cemeteries (Klementowice II, Klementowice IV). His first attempt to address the issue of funerary rites of the Neolithic cultures was the doctoral dissertation mentioned above. Later, Jan Kowalczyk paid less attention to the ways of burying the dead and funerary structures of the FBC population. He returned to this issue in a monographic article: *The Funnel Beaker Culture,* published in the book: *The Neolithic in Poland*. In this publication, he drew attention to the relatively poor equipment of graves – 60% of burials did not have any visible grave goods. If there were vessels, they were relatively poorly ornamented (Kowalczyk 1970: 161). This feature of ceramic grave inventories is specific to the FBC. Drawing attention to the poverty of the ornamentation of the burial vessels, J. Kowalczyk compared them with the opulence of ornamentation of vessels found in features associated with economic activities within the settlements (Kowalczyk 1970: 161).

Cemeteries were located mainly on uplands, and their special concentration is observed in the north-western part of the Lublin Upland: *A particularly interesting point, which has become increasingly clear in recent years, is the concentration of the cemeteries in certain parts of Poland. Post-war research has revealed a great concentration of Funnel Beaker cemeteries (over 20 of them) in the north-west part of the loess area of Lublin Upland* [...], *and the simultaneous absence of bigger settlements only a few camps were found* (Kowalczyk 1970: 161). In considering the FBC funeral rite, the author noticed the lack of classic graves and cemeteries in the Opatów Upland, where an exceptionally

intense concentration of the so-called large settlements and camps (Kowalczyk 1970: 161) was recorded. A similar situation was observed in Gródek and Trzeszczany in the Hrubieszów district; he was amazed and could not explain the lack of any FBC burials in this region (Kowalczyk 1970: 161). It is worth mentioning that many years later, as a result of intensive exploratory work – surface surveys conducted as a part of the Polish National Record of Archaeological Sites Program and excavations – numerous FBC graveyards and tombs have been discovered in the loess area of the Sandomierz Upland (Bargieł and Florek 2006a: 365; 2006b: 385; Florek 2006: 417; Kowalewska-Marszałek *et al.* 2006: 341). At site 1 in Malice Kościelne, Sandomierz district, four (megalithic) grave structures constructed of sandstone rows have been explored (Bargieł and Florek 2006a: 365); while at the site in Pawłów, Sandomierz district, *a large aboveground building with graves inside has been recorded. The construction of the building consisted of 37 wooden columns with diameter of 40–50 cm, constructed in two rows, they probably were the pillars of the roof and walls, which could be made of wattlework in vertical post construction with horizontal beams* (Bargieł and Florek 2006b: 385).

In the above-mentioned monographic article *The Funnel Beaker Culture*, J. Kowalczyk also wrote: *The commonly known megalithic forms of Kujavia type graves (long barrows) have recently been enriched by discoveries reaching further south and south-east into the Little Poland area* (Kowalczyk 1970: 161). In this way, the author referred to the unique tombs discovered at the turn of the 1950s and 1960s, in a palisade enclosure located on the Lublin-Sławinek site (Jastrzębski and Ślusarska 1985: 191–192). In these features, referring in form and shape to the Kujavia tombs, the kerb made of granite boulders was replaced with one of wooden posts.

Excavations carried out in 1987–2000 on one of the largest FBC cemeteries, at site 35 in Karmanowice, Puławy district – in addition to single graves – brought the discovery of five large grave structures with a stone casing and covered with a limestone pavement (Nogaj-Chachaj 1991: 629–630). Repeated surface surveys in the vicinity of the site in Las Stocki led to the discovery of both a large tomb with stone casing (Las Stocki, site 71), built on the remains of a destroyed camp of this culture (Nogaj-Chachaj 2000: 42), as well as previously unknown remains of small FBC encampments, located only on loess hills at a short distance from Neolithic cemeteries known from earlier studies (Nogaj-Chachaj 2000: 45). However, the search for FBC cemeteries near Gródek has not yet produced the expected results. The only inhumation cemetery of this culture was discovered under the Corded Ware culture barrow at the site Łubcze, Tomaszów Lubelski district (Bagińska 2006: 423). The problem of the absence of FBC graves in some areas has not been resolved. We still can observe a large, unexplained, disproportion in the distribution of cemeteries in the south-eastern FBC group. Their concentrations, exceptional for Polish conditions, are observed in the north-western part of the Lublin region (Nałęczów Plateau), however, they are missing from the eastern part of the Lublin Upland, between the Wieprz and Bug rivers.

The necessity to establish the chronology of features and phenomena related to the FBC and GAC activity led to Jan Kowalczyk becoming interested in innovatory methods of absolute dating – the use of radiocarbon methods in archaeology to measure the age of samples. The organic material obtained during the excavations was transferred to specialist laboratories in Cologne and Groningen. In this way, he became a pioneer in using this method for dating Neolithic features from the Lublin region and Poland.[5] For many years, the obtained results have been the basis for broad and detailed discussions on the chronological sequence and origin of Neolithic and Eneolithic cultures in Poland. Performing the 14-C dating for organic materials from pit 13 in Gródek was associated with an attempt to solve the problem of this settlement chronology. The first researchers related the age of the settlement to final stages of the FBC (Jażdżewski 1958: 284). The date obtained: 5050 ± 110 BP (KN–243; Kowalczyk 1968: 368) allowed the shifting of the beginning of the FBC settlement to a much earlier period. However, this date was controversial from the beginning. Konrad Jażdżewski verbally claimed that he expected a younger age of the settlement in Gródek, compared to Ćmielów; J. A. Bakker referring to this date asked whether there were any Lengyel culture materials in the Gródek settlement (Kowalczyk 1968: 372). In the 1980s, a far-reaching correction was made by the Radiocarbon Laboratory in Cologne. Repeated age measurement resulted in a date of 4820 ± 40 BP (Kn–I.243; Breuning 1987; Bronicki *et al.* 2004: 107; Włodarczak 2006: 28).

It is now assumed that *the stage of the large FBC settlement in Gródek takes place immediately after the late phase of the Lublin-Volhynian culture settlement cessation* and that *it can be dated at around 3650 BC at the earliest* (Bronicki *et al.* 2004: 107). The phase Gródek I would correspond to the phase of Bronocice II and partly Bronocice III, while the phase of Gródek II to the deposits from the later stage of the Bronocice III, Bronocice IV and V phases (Bronicki *et al.* 2004, Fig. 4: 108, Table 2). In addition, the dates obtained for GAC grave No. 7 from site IV (D) at Klementowice (Kowalczyk 1968: 368) caused a lot of controversy and discussion.[6] The author considered both of the age measurements conducted in the laboratories in Cologne and in Groningen to be correct (Kowalczyk 1968: 374). In addition, he believed that *the above figures allow two preliminary conclusions: 1/ They contradict the hypothesis of a long period of coexistence of Globular Amphora culture and Funnel Baker culture in the same areas, and they suggest the thesis about the invasion of Globular Amphora culture into the areas dominated by*

[5] The first date, obtained for a FBC features in Poland, was the one from the pit 180 in Ćmielów, Ostrowiec Świętokrzyski district (Jażdżewski 1961: 435).

[6] The site IV (D) in Klementowice has a unique nature. In addition to the four GAC graves, graves of the FBC were discovered there. A similar situation was observed in Klementowice II. It is worth noting that these two sites are among the few in Poland, where the graves of both cultures co-exist. In addition, on the site II in Klementowice, the only case of the stratigraphic relation between the GAC burial site and the FBC settlement pit in the Lublin region was recorded (Grave III and pit 16).

Funnel Beaker culture, which caused in the collapse of this last community. This is determined by the date from Klementowice; 2/ This date confirms the thesis about the secondary nature of the Globular Amphora culture settlement in the south-east, including the Lublin region, which excludes the possibility of locating the GAC cradle in this part of Europe (Kowalczyk 1968: 734).

Looking back on Jan Kowalczyk's publications from the perspective of the years, we can see significant and numerous reflections on the methodology of excavations and searching for archaeological sites in them (Kowalczyk 1962: 301). He knew the need to use field surveys before starting systematic excavations. His tips and suggestions on the contextual recognition of the FBC sites and the GAC graves are also valuable. He suggested conducting the observations around the sites, which would allow the discovery of new features, including graves. He also paid attention to the continuous and systematic observation of clusters of limestone raised by ploughing in the fields, which would enable the recording of all of the graves in the studied area (Kowalczyk 1962c: 303). It is also worth noting that all of the source-data publications at that time contained – presented in parallel – detailed archaeozoological analyses of discovered bone materials (Krysiak 1956; 1957). J. Kowalczyk was also a great advocate of the development of research on the Neolithic flint-work of Polish lands and skill fully encouraged the young generation of archaeologists to address these issues (Czerniak 2000: 97).

For many years, docent Jan Kowalczyk conducted intensive excavations in two areas of the Lublin region: on the Nałęczów Plateau (Klementowice, Las Stocki, Stok) and in the Hrubieszów Basin (Gródek, Trzeszczany). In the case of the north-western part of the Lublin Upland, they were of a rescue nature, in the case of the Hrubieszów Basin, they were initially associated with the activities of the "Research Commission on the Cherven Cities (or Grods)", and then with the excavations at Gródek (Zakościelna and Gurba 2007: 385). All these sites and the results of the research proved to be important for further deliberations and discussions on the development of Neolithic cultures in Poland and provided sources for new synthetic studies. In addition, J. Kowalczyk, on the basis of old and new materials, created original concepts regarding Neolithic issues. A good summary of this researcher's achievements is the statement by Lech Czerniak, in which he concludes that his work is characterized by *criticism of the existing knowledge and – above all – the perception of archaeological interpretation as a procedure involving the gathering of as many facts as possible, but mainly on the conscious use of theoretical knowledge for their ordering and interpretation* (Czerniak 2000: 96).

Some of the hypotheses and concepts presented at that time (concerning the destruction of the FBC population as a result of the GAC invasions, tribal affiliations and contacts) are now seen as somewhat archaic. However, they are situated in the contemporary research paradigm of cultural diffusionism, customary in the archaeology of the 1950s and 1960s. Careful reading of Kowalczyk's works allows us to notice

non-standard interpretations of the phenomena or interest in new research techniques and their application in archaeology (like the radiocarbon method) that may be a herald of the emerging mainstream of processualism. It is worth noting that J. Kowalczyk belonged among the pioneers of using the radiocarbon method in dating Neolithic features of the Lublin region and Poland, which gave grounds for establishing the absolute chronology of the FBC and GAC. He referred the chronology of FBC to the third millennium BC, indicating the seniority of the FBC and its parallelism with the youngest phase of the Tripolye culture and partly with the Corded Ware culture. Kowalczyk very much took on board the remarks formulated at the symposium in Prague (in 1959) that *excavations of the Funnel Beaker culture in Poland have quantitatively increased material referring to economic and social issues, buthave not produced any data for the systematisation of cultural groups* (Kowalczyk 1962b: 272). Impressed by the discussion in Prague, the author wrote a postdoctoral thesis on the beginnings of the Neolithic period in Poland (Kowalczyk 1969).

Describing Kowalczyk's achievements in research on the FBC, it is difficult to relate and deal only with the subject of this one culture. The researcher himself was fascinated by the contacts between FBC and GAC, their diversity observed both in the ceramic and flint production, as well as in the settlements.

Throughout his professional life, J. Kowalczyk was aware that: *What is happening in the field of research on many Neolithic issues, can be described as a true revolution* (Kowalczyk 1962: 271). In field and office studies, he was guided by the thought that *the greatest even subjectivity of the single assessment, if it caused criticism, contributed to the formation of proper views* (Kowalczyk 1962: 271). He considered FBC as a unique civilisation phenomenon: *The Funnel Beaker culture played a very important role in the prehistory of our country. Post-war research has shown that in most districts this was decidedly the dominating culture. The large number of sites discovered, including large and prosperous settlements, the high level of civilization, and the extensive cultural contacts with other areas, all stress the high rank of this culture* (Kowalczyk 1970: 177).

The publications of Jan Kowalczyk brought new light on the FBC in Poland, and the results obtained from excavations at sites in Gródek and Klementowice became a reference point for many generations of archaeologists.

Translated by Tomasz Myśliwiec

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The Globular Amphora Culture in the Writings of Jan Kowalczyk

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The present paper discusses the scientific and popular science publications by Jan Kowalczyk referring to the Globular Amphora culture and presents the scholar's achievements in acquiring and popularising knowledge about this taxonomic unit.

KEY-WORDS: Globular Amphora culture, genesis, chronology, economy, funeral rites, Neolithic demographics, research methodology, Jan Kowalczyk.

Jan Kowalczyk became interested in the Globular Amphora culture (hereinafter: GAC) in the earliest years of his professional career. Debuting in the scientific literature, he described, among other things, the accidental discovery of an "amphoral" grave at Stok, Puławy district on the Nałęczów Plateau (1949: 136). He maintained this interest until he retired. The last publication related to the topic was an *Introduction* written for a monographic study of the GAC cemetery in Złota, Sandomierz district (1977: 7–8). In total, there were 24 scientific and popular science texts by this author in which the "amphoral" issue was the leading theme or appeared in the wider context of research into the Neolithic (Zakościelna 1997; Zakościelna and Gurba 2007: 387).

FIELD INVESTIGATION REPORTS

There are not many direct references to the GAC in the source-literature produced by J. Kowalczyk. In effect the main cases are only the archaeological excavations carried out at GAC cemeteries on the Nałęczów Plateau (Las Stocki and Stok, Puławy dostrict) and in Mazovia (Bieniewo, Warsaw West district). In the cases of the archaeological excavations in the Puławy district, J. Kowalczyk took part in them as a young employee of the Prehistory Department of the Maria Curie-Skłodowska University and of the Department of Archaeology of the Lublin Museum. As to the excavations of Bieniewo he took part in it as a mature researcher in the Department of the Neolithic of the

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Archaeological Museum in Warsaw. He also investigated the graves in Klementowice (Kowalczyk 1957: 175; Halicki 1970: 303; Balcer 1998: 4) and in Parchatka (Kowalczyk 1964a: 149), both Puławy district.

The report of the excavations at Las Stocki and Stok carried out in 1951 under the direction of Stefan Nosek (as part of works started in 1947) is divided into three parts (Kowalczyk 1953). The first two are devoted to two examined features – collective human graves. They contain data on the circumstances of the discovery, description of grave structures (of stone), characteristics of remains of the dead (position, orientation, state of preservation), information on burial furnishing (localisation of items in relation to the skeletons). The noticing of small aggregations of charcoal, as well as small shells in the fill of the grave from Las Stocki evidences the diligence of the conducted work. In the further part of the article there are descriptions of elements of grave furnishing (everyday objects, personal ornaments and animal bones), containing also the dimensions of finds. The whole is complemented by illustrative material: the plan of the grave from Las Stocki and drawings of some artefacts (unfortunately not of all of them). Also lacking is an illustration presenting the partially damaged grave discovered in Stok, which is a significant fault of the report. Drawings of selected artefacts coming from two different graves were unnecessarily mixed up together in the tables. The third part is an analysis of the funeral rite based on two different graves, in a wider comparative context as well as an attempt to interpret the character of the burials. Already then, the young scholar tried to perceive in the feature from Las Stocki a "distinguished" individual among the "sacrifices" brought to him. The article closes with brief comments on the relative chronology of both assemblages. Kowalczyk used the division of the Neolithic into three sub-periods (I–III), whereby he considered the grave from Las Stocki (devoid of ceramics with corded ornamentation and without heart-shaped projectile points) as older than the one from Stok, where these elements occurred.[1] He explains their presence as resulting from contacts with the communities of the Corded Ware culture, which allows us to infer that he treated the latter as coincident with the younger phase of the GAC. An additional research achievement of J. Kowalczyk was the resolution of doubts as to the possibility of using the bow by the population of the GAC, expressed by Józef Kostrzewski (1939–1948: 148). The presence of projectile points in the tomb from Stok unambiguously solved this matter.

The second report of J. Kowalczyk was written together with Anna Uzarowicz (Uzarowiczowa and Kowalczyk 1973). This is a text discussing the activities undertaken as part of the intervention of the State Archaeological Museum in Bieniewo, West Warsaw district, after the accidental discovery and damage to a tomb of the GAC located there. An area little over 186 m^2 was excavated, which allowed the identification

[1] Later, the author acknowledged that the presence of corded ornamentation (or lack of it) does not determine the chronological position (e.g. 1977: 7).

not only of the grave (a cist burial with a cover), a feature in its vicinity and a fire pit, as well as the fairly wide context of these features. The article contains data on the location and description of the megalithic structure, giving its orientation (W–E, with some deviation towards the north) and dimensions, indicating the existence of two concentrations of charcoal outside the burial chamber. The authors describe the bone remains, based on the opinion of the anthropologist Alina Wiercińska, providing determination of sex (woman) and age (*juvenis*) of the deceased. They provide data on the location of the furnishings of the burial and detailed descriptions of its elements. All items were measured and drawn. In the further part of the study, the authors described the "chamber adjoining the grave" and illustrated it with a site plan. It was found that in the eastern part of the "feature adjoining the grave", an isolated square chamber with traces of charred wooden beams was identified. In its western part, next to the charcoal, two clusters of cow's teeth and seven small fragments of the body of a GAC ceramic vessel were found. In addition, remains of a hearth with a large part of a pot-shape vessel with corded ornamentation were discovered.

In the analytical part, the authors compare the finds from Bieniewo with other artefacts from the Lublin-Mazovian and Warmian-Masurian group of the GAC, but they do not find good analogies. The complex nature of the feature (human grave, chamber with cattle remains and hearth) corresponds most fully to the situation in Zdrojówka, Koło district and to that of the grave II from Rańsk, Szczytno district. The authors are distrustful of the findings of S. Nosek (1967) and Tadeusz Wiślański (1966a) as to the division of the GAC into territorial groups on the basis of differences in ceramics only. According to them, it is necessary to take into account also the form of the grave. Graves made of large stones (megalithic ones), as well as features with the earliest chronology, would be a testimony to the "northern" cradle of this culture. Therefore, according to the authors, the mechanical classification of the feature from Bieniewo to the Mazovian-Lublin group or the Lublin sub-group is not justified. They share an interesting opinion of Lidia Gabałówna – that is, however, difficult to prove – that the burials of a pair of cattle separated from the human remains by an empty space may indicate that the deceased was brought to the grave on a sled or cart drawn by the oxen (cows) that were sacrificed and the vehicle (now completely decayed) had been in what was the empty place found by excavation (Gabałówna 1958: 92). This type of burial was known from the Near East. The article concludes with a deduction – a methodological postulate – to study the broad terrain context surrounding the "amphoral" graves and to return to the study of graves previously discovered, but not in sufficient degree excavated.[2]

[2] This postulate was returned to in the theoretical article *Źródłoznawcza problematyka archeologii* (Kowalczyk 1973: 11).

RADIOCARBON DATING

Jan Kowalczyk was a pioneer in radiocarbon dating. Before 1967, there was only one date for Pit No 180 belonging to the Funnel Beaker culture (hereinafter: TRB) from Ćmielów, Ostrowiec Świętokrzyski district. Two texts were written about the results of the C14 measurement, referring to two archaeological sites: Gródek on the Bug, Hrubieszów district and Klementowice, Puławy district, which also include the interpretation of the dates obtained (Kowalczyk 1968a; 1968b). The author emphasized the positive role of Jan Albert Bakker, thanks to whom contact was established with the laboratory in Groningen, and of Hermann Schwabedissen, who made it possible to date the samples in Cologne. Another samples examined were those from the sediment of Pit No 13 from Gródek site I C, belonging to the TRB, and from the grave No. 7 from the cemetery in Klementowice, site D/IV/, currently site 4 (Bronicki 2016: 93–102). An unique fact is that the material from the grave discovered in Klementowice was dated at the same time in two laboratories: in Cologne – charcoals (KN–255: 2490 ± 160 BC) and in Groningen – charred bark (GrN–5046: 2225 ± 30 BC). After the calibration made today according to the OxCal v4.2.4 program by Christopher Bronk Ramsey (2009), using the INTCAL13 calibration curve (Reimer *et al.* 2013), with a probability of 68.2%, the following dates were obtained: Cologne: 3007–2883 BC, Groningen: 2878–2697 BC (Włodarczak 2016: 538, Table 1). J. Kowalczyk thoroughly described the context of the collected samples: he gave a detailed description of the grave and human remains – along with anthropological assessment – and an inventory of the grave furnishing. He also presented the significance of the results for the study of prehistory:

1) The GAC is a taxonomic unit younger than the TRB. At the same time, the possibility of a longer coexistence of both cultures in the same areas should be ruled out. Most likely is the GAC communitie's invasion on the territory occupied by the populations of the TRB. This could definitely have contributed to the disintegration of the older settlements and the culture that they represented. The date from Klementowice would mark the beginning of the "amphoral" settlement, and at the same time the end of the "Funnel Beaker" one in the Lublin region[3].
2) Finds of the GAC in the south-eastern territories (Volhynia, Podolia) and in the Lublin region belong to its late phase, which excludes the localisation here of the "cradle" of this culture. This statement indicates that by this time, J. Kowalczyk had stopped taking seriously the hypothesis of Vere Gordon Childe (1925) and Marija Gimbutas (1956: 150–151) about the origins of the GAC in the Black Sea area.

[3] Compare recent discussions of the chronology of the GAC in the Lublin region (Włodarczak 2016 and Bronicki 2019, with further literature).

SYNTHESES, MONOGRAPHS

Neolithic funerary customs occupy an important place in area of interest of J. Kowalczyk, an expression of which was his unpublished doctoral thesis *Obrządek pogrzebowy w młodszej epoce kamienia na ziemiach polskich* [*The funeral rite in the Later Stone Age in the Polish lands*], defended in 1951 (discussion of doctorate: Nosek 1951). The writing of the part referring to the GAC was based largely on the results of research conducted on the Nałęczów Plateau. The post-graduate student noted that the GAC graves are primarily located on eminences. He notes their diversity, from rarely occurring pit graves, to complex megalithic graves with auxiliary stone constructions. He also finds that graves are more frequently oriented along the E–W axis. Kowalczyk states that almost 50% of the GAC graves are collective burials. He also perceives a chaotic arrangement of the remains of the dead and cannot discern any regularities in the orientation of the skeletons. He suggests this reveals the lack of rules in this regard. At the same time, he adds that the funeral rite encountered is the phenomenon of "scorching" of the remains of the dead in the graves. He also states that the furnishing of the GAC graves are most often vessels (63% of graves) and axes. This suggests the possibility of distinguishing some of the dead ("the main individual") for whom others were sacrificed; thus, he polemicized with the prevailing view of the treatment of the collective graves as family burials.

Development of the issue concerning collective graves was presented in a text published 11 years later (Kowalczyk 1962b). The Author once again took a position on the opinion prevailing at that time that these were family graves (e.g. Kozłowski 1921: 15; Kostrzewski 1930: 99). Drawing on the achievements of other scholars and on personal reflection, he presented a different perspective on this issue. It is a view that at least some of the GAC graves contain burials of a "distinguished" individual as well as remains of human sacrifices made on their behalf (cf. Maringer 1942–1945: 112; Nosek 1954–1955; Sulimirski 1957–1959: 272). Situations of this type were noted by Kowalczyk in the graves from Borucin and Świerczyn, both localities in the Radziejów district (research by Leon Kozłowski: 1921: Tabl. I and VI), from Pikutkowo, Włocławek district – research by Stanisław Madajski (Jażdżewski 1937: 98) and from Klementowice, Puławy district Cemetery B, Grave I, (research by S. Nosek 1954–1955: 66). He believed that family graves, of course, also existed, but each collective burial requires a detailed analysis to allow its proper qualification. In Kowalczyk's opinion, "distinction" may be marked by the following traits: alignement (position) and localisation of the remains of the "main individual" in comparison to the arrangement of the other dead ("victims"), the quality and quantity of grave goods grouped next to the "distinguished individual". Other hints include, for example, making one part of the burial chamber in a different way than the other parts, e.g. more thoroughly, with additional

stone cobbling or the use of additional stones in the cist surrounding the remains of the "main" deceased.

The scholar claims that among all the graves of the GAC that have been well published, there is no single grave, all are collective graves. It is not possible to agree with this conclusion, however, because now we know many "amphoral" graves containing the remains of single individuals, and they are now known to be quite numerous features of the Eastern Lublin group, studied e.g. in Łopiennik Dolny-Kolonia, Krasnystaw district, Poniatówka, Chełm district and in Sahryń, Stefankowice-Kolonia, Strzyżów, all in the Hrubieszów district (Bronicki 2016).

The sacrificial character of the burials is suggested, according to J. Kowalczyk, by the presence of a double-ended bone point among human remains in Grave No I in Cemetery B in Klementowice – analogically as among the bones of cattle in animal graves (Gabałówna 1958: 92). It is possible that this is an item with which a ritual death was inflicted. It seems that an explication of this type is highly probable in the light of the discovery in Czułczyce-Kolonia, Chełm district, where a perforator made of bone was found stuck between the cervical vertebrae of one of the dead (Bronicki 2000: 185, 187).

An interesting observation of J. Kowalczyk is that the "distinguished" individual could be a woman who was accompanied by "victims" composed of men. A situation of this type occurs in the tomb examined at Las Stocki, in the G cemetery (Kowalczyk 1953: 46; Dzierżykraj-Rogalski 1955: 80–81).

The scholar's arguments are complemented by traces of cannibalism being found within the same feature. A human skull with traces that were hypothesized as a "result of frying the brain in the calotte" appeared here (Dzierżykraj-Rogalski 1948: 251), as well as split long bones (with the aim to extract the marrow?) and traces of their "scorching".

At the same time, a text of monographic and popular-scientific character, *Lud kultury amfor kulistych* [The People of the Globular Amphora culture] was published by J. Kowalczyk in two subsequent cahiers of *Z otchłani wieków* (Kowalczyk 1964a; 1964b). It has been written in the form of a spoken story. It refers only to the GAC, whose community the author includes among the ancestors of contemporary Poles. The article begins in a journalist style with a report on the many years of excavations carried out in the Nałęczów Plateau, in which the author participated. He repeats here in an approachable manner his opinions, which had been expressed in more serious form in other publications. He believes that the grave with four skeletons excavated in Klementowice (in 1950) had been constructed at one time for the four occupants who had died at the same time. A double-ended bone point, found for the first time in Europe in a human grave, suggested that some individuals could have been killed with its help. These would be "sacrifices" for a "distinguished", central person. At the tomb at Parchatka, examined a year before, such a "point of death" was also found

among the skeletons of cows. J. Kowalczyk supposes that the young woman buried in this grave could have been the wife of a "distinguished" man and died to accompany her husband on the journey to the afterlife. He mentions analogies from the Kuyavia region (Świerczyn, Borucin grave II) and from Mazovia (Potyry, Płońsk district: Sawicki 1920). The tomb at Las Stocki probably also contained the remains of a "distinguished" individual – a young woman with an infant for whom two men were sacrificed, which may indicate the important position of women in the GAC communities. Kowalczyk noted that this fact would be inconsistent with the patriarchal model, usually dominant among nomads. In the further part of the article the elements of the grave goods were discussed: vessels (with food), tools, weapons, personal ornaments, elements of carcases, sometimes in the form of jawbones of a wild boar, which could be a totem animal, sometimes whole or almost whole cows, found also in separate animal graves. This dual character of the burials renders interpretation difficult, because a separate grave of a bovine may be testimony to the "deification" of the cow (analogical to ancient Egypt), while the presence of cattle remains in a human grave may indicate that cattle formed a part of grave goods.

The Author emphasizes the destructive and grim role of the GAC communities in prehistory. He connects the disappearance of the FBC with attacks from the GAC, as evidenced by the burning of the settlement in Gródek. The period of dominance of the TRB communities is referred by him to as the "golden age of the Stone Age", and the GAC communities – as "Vikings of the Neolithic".[4] The argument supporting this reasoning is the fact that in Klementowice one of the "amphoral" graves has damaged a "beaker one", which testifies to the earlier chronology of the latter and the fact that the GAC community found itself in an environment previously exploited by the TRB.

In the rest of the story, the scholar describes the GAC settlement in Mierzanowice, Opatów district – the first one in Poland – discovered in 1935 by Kazimierz Salewicz. The lack of traces of buildings leads to the conclusion that huts had stood there, and these constituted the basic form of residential construction of nomadic shepherds – stock herders of cattle and pig as well as of sheep and goats. He wonders whether the GAC community knew agricultural cultivation of cereals. He leaves this matter open.

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[4] In an earlier popular-scientific text (1959b: 172), J. Kowalczyk suggests that in antiquity (in Neolithic times), the Lublin region served as *an important bridge in contacts between the Vistula lands and the cultural centres of the Near East,* which were *a land densely populated, with bustling large "settlement centres".* The TRB was a group that exhibited a high level of cultural development, living in wooden and clay houses built on the surface of the earth (and not in dugouts, as among early Slavs 3000 years later), equipped with copper metallurgy. They were the owners of large cattle herds and producers of grain. Prosperity ended abruptly due to some movements of the population, when a large settlement in Gródek nad Bugiem was burnt, the seats of the Tripolye culture and Troy II were destroyed and the Hittite state came into existence in Anatolia. One can guess that the author, in the case of the burning of Gródek, has in mind the GAC aggressors, although this name was not mentioned.

He also draws attention to the possibility of exploitation of the banded flint (in the mine in Krzemionki Opatowskie [Krzemionki, Ostrowiec Świętokrzyski district]), which was used to make the famous wholly polished axes that were to be found in graves. However, he also does not prejudge this matter, presenting the hypothesis that it is just as possible that anyone else could have mined flint for export for the GAC community. He mentions the production of tools of bone (e.g. double-ended points known from graves) and of ceramics, critically assessing its poor technology, and highly appreciating the ornaments. He concludes that the clay vessels were not very important in the nomads' life, equipped probably also with containers of leather and wood. The poor technology of ceramics may – in his opinion – indicate the connexion of the GAC with the zone of the lowland forests, remaining in opposition to the loess zone of the old uplands, where good quality vessels were produced from the beginning of the Neolithic.

The phenomenon of the widespread use of amber, treated as a favourite raw material for the production of personal ornaments, can be interpreted as a reminiscence of a longer stay of the GAC communities on the shores of the Baltic sea, which may be important in considering the genesis of this taxonomic unit. Kowalczyk also speculates about the meaning of amber beads in the shape of a double shaft-hole axe, which can be interpreted as some form of relation with a thundering deity, and the use of fire can be combined with solar beliefs (in favour of the existence of which in these communities is the presence of the "sunny" ornament on the cover found in Grave II at Las Stocki, in cemetery C). Kowalczyk was also considering the interpretation of the habit of burning bonfires in graves. He shares the opinion of Stanisław Ciszewski that *the bonfire is an altar-mediator between the living ones and the ancestors' spirits and the entire transcendental world* (Kowalczyk 1964b: 224).

The GAC occupies an important place in the famous dissertation of J. Kowalczyk: *Początki neolitu na ziemach polskich* [*The Origins of the Neolithic Age on Polish Territories*] (1969). Although this culture is classified (in chronological terms) as Later Neolithic, many researchers stress the participation of Mesolithic traditions in its emergence. For this reason, J. Kowalczyk included it in the discussion of the beginnings of the Later Stone Age. He considered that in the Polish territories, regardless of the time when it happened, early-Neolitic communities were also those belonging to cultures that originated from the Mesolithic substrate, undergoing Neolithisation. According to this approach, the "early-Neolithic" cultures of this region would be not only the Linear Pottery culture, but also the TRB and the GAC cultures. The further part of the study is devoted to divagations about the definition, extent, territorial division, chronology, genesis, and the search for the "cradle" of the GAC.

Discussing the territorial division of this culture, J. Kowalczyk polemicized with Tadeusz Wiślański (1966a), who divided it into three great units: the western, Polish and the eastern ones. He also suggested the existence of a fourth group: the northern

(or north-eastern)one, where, according to him, the "cradle" of this culture should be localisated.

In the further part of the study, J. Kowalczyk cites very different views on the chronology of the GAC: of Konrad Jażdżewski (Chmielewski, Jażdżewski and Kostrzewski 1965: 114–115), of T. Wiślański (1966a: 127, 130; 1966b: 20–21, 24), of Valentin Weber (1964: 187), Hermann Behrens (1965: 1, Fig. 1), Tadeusz Sulimirski (1957–1959: 277). In his opinion, the beginnings of this culture did not reach the times corresponding to the older phase of the TRB settlement in Gródek nad Bugiem or the CI/CII phase of the Tripolye culture, and especially the times of the Stroke Ornamented Pottery culture. He believes that T. Sulimirski is also wrong in opting for the very late chronology of the GAC. However, in his opinion, the GAC is correctly dated to the third millennium BC.

Kowalczyk further considers three concepts of the localisation of the cradle of the GAC:

1) on the middle-Elbe –the concept once promoted by Nils Herman Niklasson (1925: 169), a Swedish archaeologist, working at the museum in Halle, and by German archaeologists: Ernst Sprockhoff' (1926: 83; 1938: 129–130) and Hans Priebe (1938: 62–63), due to the significant concentration of sites of this culture in the area of the middle Elbe;
2) in the south-east (from the area of the Black Sea) – supported by V.G. Childe (1925) and Marija Gimbutas (1956: 150–151), for whom crucial was the occurrence of cist graves as well as animal burials, the characteristic position of the dead (on the side), the presence of collective graves – because according to their view these are the Black Sea and southern traits;
3) in the north – the concept created for nationalist reasons by German scholars, among others Gustav Kossinna (1910: 59), rejected with the fall of the Third Reich – according to which the GAC communities represent "early Germans" taking possession of the subsequent territories of Central Europe after leaving the northern territory. In later years, this concept was returned to, while rejecting the ethnic affiliation and clearly defining that it concerns an area from Kuyavia to eastern Brandenburg; these views were represented by T. Sulimirski (1957–1959: 276 and f.), T. Wiślański (1963: 259), and V. Weber (1964: 192).

Arguing against M. Gimbutas, J. Kowalczyk cited examples of deliberately chaotic arrangement of some skeletons (it is justified to see this as a ritual practice), while individuals "distinguished" ("main ones") were buried in an upright position. This last feature is undoubtedly borrowed from the north. On the other hand, he agrees that sprinkling bodies of dead people with ocher is a cultural element essentially taken over from the south-east, but considered this practice as secondary.

Generally, J. Kowalczyk was in favour of the northern "cradle" with some deviation to the east – to the area of the forest-Neolithic domain (as evidenced by the use of double-ended bone points and the brittleness of ceramics), which means questioning the hypothesis of T. Wiślański and others. According to J. Kowalczyk, the home area of the GAC should be located north of the Kuyavia region, which at that time was occupied by the TRB communities. According to this opinion, Kuyavia would have been an early but secondary centre of the GAC (repeating this idea after T. Sulimirski), and the real "cradle" should be sought in the area of the lower Vistula. This area was in close contact with the extent of the compact occurrence of the Pit-and-Comb Pottery culture in the east, and in the west, it was in contact with the megalithic idea spreading from the west, from the region of the lower Odra.

According to J. Kowalczyk, the stages of GAC development would be the following:

stage 1: formation of a separate culture in the home area (in the "cradle");
stage 2: creation of a secondary centre in Volhynia (migration);
stage 3: population shifts from Volhynia to the west – to the Lublin region (expansion).

The author emphasizes the relationship of the GAC in its oldest phase with Mesolithic (retarded forest communities), manifested by the presence of trapezoidal projectile points.

The above-presented reflections were collected again in one place, in the popular science book *Zmierzch epoki kamienia* [*The Twilight of the Stone Age*] (1971c). It is not meaningful to repeat them. However, it is worth mentioning what the new publication brought to the knowledge of the GAC and understanding of this culture by J. Kowalczyk. The researcher made it clear that the probable factor triggering the crisis "after the period of stabilisation and prosperity", i.e. at the end of the Neolithic period, were large population movements caused by a catastrophic famine that affected the shepherds due to the destruction of pastures in the East European zone due to several years of drought. At that time, there was a strong secondary GAC centre in Volhynia, established as a result of migration from the north-west taking place along the eastern border of the TRB. This group had to move to the west, to the Lublin region covered by the settlement of the TRB communities, and to the south in the territory of the Tripolye culture.[5] Expansion to the areas on the upper Bug would have been confirmed by the burning of the TRB settlement in Gródek, and the establishment of large TRB

[5] This view coincides with the opinion of T. Sulimirski, quoted by J. Kowalczyk (1971c: 101), who mentioned that in the Werteba cave in Bilcze Złote in Podolia, an "amphora" axe was found among the broken human bones of representatives of the Tripolye culture.

settlements on the tops of the hills above the central Vistula River would be a response to the threat (from the GAC) from the east. The corded ornamentation, as well as "some other decorative motifs" in the TRB ceramics, would have been the result of the influence from the circle of the GAC.

In the further part of the work, the author reviewed opinions on the economic foundations and the lifestyle of the GAC population. He advocated against the thesis about the dominance of agriculture in this culture, because there are no large settlements in the areas it occupied. However, the presence of querns and grinding stones, as well as a grain impression on a vessel from Mierzanowice, is explained as testimony to obtaining grain from farmers from another culture or the existence of initial forms of agriculture. It is worth mentioning, however, that a few years later Zygmunt Krzak discovered such large settlements (Krzak 1983/1989: 270). The minor importance of hunting is shown by a definite quantitative dominance of the bones of domesticated animals over the wild ones in the settlement in Mierzanowice, but also in graves, where, however, found were boar's tusks and deer antlers. In addition, J. Kowalczyk believed that characterising the GAC community as "merchants" also does not correspond to the truth, because this statement can only apply to a small group of people, not the whole community. However, the frequent presence of weapons in graves justifies claiming the belligerent character of the representatives of this culture. Ultimately, J. Kowalczyk pronounced himself in favour of the view of the dominant role of the pastoral and breeding economy (after V. G. Childe). According to him, this state of affairs certainly prevailed in Volhynia and the Lublin region, although in the historical areas of East Prussia and Mazovia – not necessarily.

Further, J. Kowalczyk dealt with manifestations of the activity of the GAC peoples in the field of everyday life. He wrote that the building construction is hardly known, from that it can be concluded that the nomadic dwellings were light huts with a hearth, and the form of settlement was temporary camps. He makes review of the most important fields of manufacturing: flint, pottery, bone and amber processing. He dealt a bit more with evidence of exchange, writing about amber artefacts and cattle. He polemicized with the opinion that young cattle individuals could have been exchanged for axes of banded flint in the mining TRB settlement in Ćmielów. According to him, there is no certainty that Ćmielów was a mining settlement, and the remains of cattle found there did not have to have originated from their import from the population of the GAC, because cattle breeding was well known among the TRB communities. In addition, the GAC axes were rather not produced by representatives of the TRB, because their products were different. The author believed that the GAC had its own mining specialists. That the GAC could produce its own axes is shown by the fact that they were manufactured, among other things, in the GAC settlement in Mierzanowice.

Then, turning to the beliefs and rituals, J. Kowalczyk mentioned cannibalism and ritual bonfires in the graves examined on the Nałęczów Plateau. Speaking of collective burials with the "main" individual, he stated that the victims could be both people killed during the funeral ceremonies and the remains of previously deceased people. Continuing the considerations regarding the funeral rite, J. Kowalczyk did not support the current views about the existing of the "megalithic religion", promoted by V. G. Childe, explaining that the megalithic grave is an artificial cave, probably invented independently in different cultures and in many areas. Further, he dedicated a few sentences to animal graves, which he had already interpreted elsewhere. Concluding this part of the considerations, J. Kowalczyk questioned the thesis about the patriarchal type of social relations, which he regarded as quite doubtful in view of the fact that in the Las Stocki collective grave, it was a woman who was the "distinguished" occupant.

In the conclusion, the author returns to the issue of the "cradle" of the GAC – indicating the areas in the lower Vistula area on the border with the forest zone as the place of origin of this taxonomic unit. He also speaks about the huge role of the "amphoral" communities in the genesis of the Złota culture.

THEORETICAL REFLECTIONS

J. Kowalczyk devoted a lot of space in his scientific output to theoretical and methodological considerations on the problems of the Polish Neolithic and research postulates regarding his favorite epoch. In the entire cycle of this type of work, the GAC appears quite often, but usually is recalled as an illustration of some general theses. Undoubtedly an important statement is the opinion of Kazimierz Tymieniecki, shared by J. Kowalczyk, that during the Neolithic the *basic core of the population living in the Odra and Vistula basin did not undergo any major changes* (Tymieniecki 1952: 15; Kowalczyk 1962a: 279). This remark also applies to the GAC, which was formed, according to Kowalczyk, as a result of the gradual Neolithisation of local Mesolithic communities (Balcer 1998: V), which can be confirmed by the presence of finds of "Janisławice" type (trapezoid projectile points) in its inventories (Kowalczyk 1971b: 250; cf. also Balcer 1971).

In considerations concerning the chronology of the Later Stone Age, we also find reflections referring to the GAC. Kowalczyk was aware that in its traditional division into the older and younger phase, the significance of presence of corded ornamentation or its lack needed to be thrown into question. He believed the researchers for whom the appearance of cord imprint is a determinant of its later developmental period were incorrect (Kowalczyk 1971a: 408; 1976: 182; also 1977: 7). At the same time, he thought

that there was a certain contemporaneity of the GAC and the final phase of the Tripolye culture (1971b: 250).

Among the research postulates concerning the GAC whose topicality is incontestable, the necessity to conduct research on the settlements that were "difficult to detect" (Kowalczyk 1971a: 406) must be mentioned. This results from the fact that the previous scope of cognition of this culture had a very one-sided character because it was largely based on the examination of graves (Kowalczyk 1963: 70).

Another interesting idea of J. Kowalczyk was the postulate of making an inventory of all the places where there are concentrations of stones on the loess fields of the Lublin region. Because in large part, they may be archaeological sites – damaged grave features with stone structures. Radio and television (Kowalczyk 1975: 31) would have their part in collecting information from residents.

In a text discussing the possibilities and necessity of cooperation with auxiliary sciences of archaeology, among others with anthropology, J. Kowalczyk, convinced of the importance of anthropological types for the reconstruction of migration and intra--tribal relations, claims that in this respect human remains from collective graves should be investigated more widely than they had previously been (Kowalczyk 1968c: 84).

DISCUSSIONS AND REVIEWS

This form of scientific expression was used by J. Kowalczyk quite rarely. Only two published works of this nature have been found in his entire output (1959a and 1977). The first is a review of an English-language prehistoric synthesis by M. Gimbutas, discussing the prehistory of Eastern Europe, including the Polish territories (Gimbutas 1956). J. Kowalczyk agrees with the thesis which the author quotes after Włodzimierz Antoniewicz that the Złota culture has very serious references to the GAC. Her arguments regarding the "cradle" of this culture also appealed to him, which he stated as follows: *the Author's reasoning justifying the eastern origin of the Globular Amphora culture, more precisely from the area north of the Black Sea deserves attention* (Kowalczyk 1959a: 269) to what can – in his opinion – indicate also the foreign character of this culture in the TRB environment in the Lublin region and the destruction of the settlement in Gródek by invaders from the east. It is worth noting here that this position was soon abandoned by J. Kowalczyk in favor of the thesis about the northern "cradle" (in the area of lower Vistula). The scholar disputes, however, with M. Gimbutas' opinion about the presence of the GAC graves in the multicultural cemetery in Mierzanowice, because he thinks that they are not there at all (but there are graves of the "Mierzanowice" and "Złota" cultures as well as "corded" graves). He appreciated the work of M. Gimbutas as a "valuable" work that "gives a broad overview of the evidence and issues".

The second text is an *Introduction* to the collective book he edited – a monograph of the GAC cemetery "Gajowizna" in Złota, Sandomierz district: *Cmentarzysko kultury amfor kulistych w Złotej Sandomierskiej* [*Cemetery of the Globular Amphora Culture in Złota Sandomierska*] (Wrocław 1977), provided with chapters written by an archaeologist (Z. Krzak), anthropologist (B. Miszkiewicz) and archaeozoologists (K. Krysiak and A. Lasota-Moskalewska). A completely new observation, included in the publication, and appreciated by J. Kowalczyk, is the existence of "comprehensive, multi-segmented" burial grounds, where the chamber with human remains is accompanied even by three additional features (previously it was thought that there could be at most one, and that this phenomenon occurs quite rarely). The fact of the existence of such four-segment complexes undermines – according to J. Kowalczyk – the thesis of the antecedence of ceramics without cord ornamentation, because in inventories of features constituting part of a complex constructed in one action can occur both ceramic finds decorated with cord ornaments and without it. Kowalczyk also points out the archaic nature of the racial traits of three determinated individuals with a paleoeuropoid and laponoidal components and lack of remains of old men. He also refers to the results of archaeozoological analysis, which showed that the cattle of the GAC community from Zlota had a more primitive character than those identified on other sites of this culture, while beingclose to the cattle of the TRB community. The author of the *Introduction* sums up the publication by suggesting that the accumulation of archaic features justifies the need to create new hypotheses regarding the genesis of the GAC, and "even the entire Neolithic".

ENCYCLOPEDIA ENTRIES

Already in the mid-sixties, J. Kowalczyk was considered an outstanding expert on the Late Stone Age. This opinion probably decided that the editors of the thirteen volume *Wielka Encyklopedia Powszechna PWN* [*PWN Great Universal Encyclopedia*] entrusted him with the writing of the entry "Neolithic", published in the seventh volume of the publication (1966: 282–283). In the context of the comprehensive view of this period presented there, the GAC takes little space. The author, in accordance with his views previously presented elsewhere, speaks of the Central European origin of this taxonomic unit and treats it as one of the elements of the Final Neolithic "great population movements" that "caused the decline of the Black Sea and Central European" cultures experiencing at that time a heyday. He treats the GAC as a disintegrating and destructive factor (next to the communities of the Corded Ware culture).

Kowalczyk was also the author of the entry "Amfor kulistych kultura" [Amphora Globular culture] in the *Encyklopedia sztuki starożytnej. Europa, Azja, Afryka, Ameryka* [*Encyclopedia of Ancient Art. Europe, Asia, Africa, America*] (1974a: 48–49). It is not

signed by name, but the authors of his obituary include it among the achievements of the scholar (Zakościelna and Gurba 2007: 387). The text starts with an explanation of the origin of the name (from the characteristic form of the vessel – amphora). It then gives the current ideas of the dating (2500–2000 BC), extent (from the Elbe to the Dnieper and Moldova), economic foundations (pig and cattle breeding). It characterizes the forms of settlement (small, indigent camps, lacking traces of houses or dugouts), mentions the production of axes from banded flint and the emphasized the role of amber as a raw material for making ornaments. The author briefly describes the funerary architecture and the rite (stone chambers, lack of cremation, frequent collective burials with one "distinguished" deceased, accompanied by human victims), cannibalism, animal graves (of cattle). He concludes that these are unique characteristics distinguishing the GAC from other cultures. He evaluates its prehistoric role negatively by writing: *No doubt it contributed to the breakdown of the structures of older farming communities* (1974a: 49).

The same publication contains one more entry by J. Kowalczyk: "Neolithic" (1974b: 337). Although the name GAC does not appear here at all, one can guess that the statements about the practiced funeral rite (inhumation) and the dissemination of the megalithic idea also apply to the "amphoral" communities, and the opinion that [...] *some peoples practiced cannibalism, also offerings of human and animal sacrifices were brought to the dead*, refers in particular to the communities of this culture.

SUMMARY

Jan Kowalczyk was a researcher of the Neolithic who marked his presence in the process of understanding the GAC in the following ways:

1) Looking for a "cradle", he modified the concept of a northern localization of its home territories, pointing to the area of the lower Vistula, at the interface with the Pit-and-Comb Pottery culture, in the zone of megalithic influences reaching from west of the lower Odra. He excluded the origin of the GAC from the Black Sea steppes.
2) He linked the chronology of the GAC to the third millennium BC, indicating that the FBC was older than it, and pointing to its contemporaneity with the youngest duration period of the Tripolye culture and partly with the Corded Ware culture. When considering whether the GAC can be included among Early Neolithic cultures, he accepted this idea, however, only in the sense of the degree of Neolithisation of the Mesolithic substrate (adopting a new economic model). In reference to the absolute chronology, he argued that it is a taxonomic unit that must be assigned

to the Late Neolithic. As to its periodisation, Kowalczyk rejected the use of the impressed cord ornamentation as a dating element.

3) He pointed to the dominant role of mobile breeding in the economy of the GAC (with the possibility of initial farming and some role of hunting); it must be mentioned here that this was not a widely accepted view at that time.
4) Analysing the funeral ritual, J. Kowalczyk came to the conclusion that in collective graves one can distinguish the "main" individual and human "sacrifices", which constituted a new concept in interpreting graves of the GAC, previously considered as "family burials". It is interesting to note his statement that this "distinguished" person could have been a woman; this thesis called into question the view of patriarchal intra-group relations in this community.
5) Reflecting on Neolithic demographics, J. Kowalczyk concluded that in the Polish territories *the core of the Neolithic population, throughout the entire epoch was the same* (Kowalczyk 1962a: 279), while at that time prevailing was an opinion of relentless migrations and influx of new waves of settlers. However, he also recognized that the GAC was an alien element, a destructive factor, arriving in the Lublin region from Volhynia (from the secondary centre), which initiated the Late Neolithic migrations and contributed to the collapse of the FBC and of the Tripolye culture at their cultural apogee.
6) Also important are the thoughts of J. Kowalczyk regarding the methodology of the archaeological research. In particular, he pointed out that the graves of the GAC should be examined together with their surroundings, which makes it possible to discover the accompanying features.
7) The thoroughness and precision of the excavations of J. Kowalczyk deserves to be emphasized, as well as the high substantive quality of his reports on graves of the GAC, usually containing anthropological and archaeozoological expert reports (this was not a common phenomena at the time) and the use of radiocarbon dating to chronological considerations, which puts J. Kowalczyk among the pioneers of using this method in Poland.

Translated by Andrzej Leligdowicz

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Studies on the Beginnings of the Bronze Age in South-Eastern Poland

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The article refers to Jan Kowalczyk's interest in the transition from the Neolithic to the Early Bronze Age in Poland, as well as observations regarding the technological and morphological features of ceramics in the context of his research in Gródek, Hrubieszów district.

KEY-WORDS: taxonomy, Corded Ware culture, Mierzanowice culture, Strzyżów culture, Jan Kowalczyk.

The issue of the Bronze Age was beyond the mains focus of Jan Kowalczyk's research interests. However, during the excavations in Gródek, Hrubieszów district, conducted in 1954–1957, he excavated four graves (Kowalczyk 1959: 1, published – Głosik 1958a; 1958b), which in the preliminary report were attributed to the Corded Ware culture (Kowalczyk 1957: 301). That inferrence was based on the similarity of the ceramic material to vessels previously discovered in Strzyżów, Hrubieszów district (Podkowińska 1936). At that time, about 90 sites related to the Corded Ware culture, that ended the Neolithic period, were known in Central and Eastern Poland. They were usually represented by single artefacts (Nosek 1957: 84–88, 423, map VI). Such a classification was based largely on intuition, which can be explained by the randomness of selection and stylistic incoherence of the artefacts. Various bifacial tools – arrowheads, bifacial points and sickle-shaped knives etc., of various types and varieties, were assigned to this culture, but much later some of them (e.g. Nosek 1957, table XVIII, XIX) were correctly assigned to cultural units dated to the beginnings of the Bronze Age (Libera 2001: Fig. 37), others (e.g. Nosek 1957: Fig. 30) even to the later phases of this period (Libera 2001: Fig. 39). This also applies to some of the ceramics, arbitrarily related to the Globular Amphora culture, Corded Ware culture or Mierzanowice (*vel.* Tomaszów) culture, (e.g. Nosek 1957: Fig. 27–29, Table XIII: 1, XX: 5, 6). This practice clearly reveals that the state of knowledge about the end of the Neolithic, and the situation at the beginning of the Bronze Age, was very unsatisfactory. From the perspective of cultural taxonomy as it is currently understood, the material thought at that time to

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represent the Corded Ware culture went beyond the framework of the late Neolithic, extending into the early phases of the Bronze Age.

When J. Kowalczyk classified the grave inventories from Gródek (Kowalczyk 1957), the results of excavations in Strzyżów, where a significant assemblage of material relating to the Early Bronze Age had been excavated, had not yet been published, but only signalled in a interim publication (Podkowińska 1936). However, it was widely believed that this was a Neolithic assemblage. In the first post-war syntheses of the prehistory of Poland, *de facto* reflecting the state of research from the late 1930s (Kostrzewski 1939–1948: map 6) , the map of Early Bronze Age settlement in this part of the country is a blank area. On the other hand, it was thought that the Corded Ware culture still existed here (Kostrzewski 1949: map I). Stefan Nosek (1957: 92–94, 424, map VII), however, singled out the sites of Mierzanowice (Tomaszów) culture in the Lublin region, in which he, incorrectly, included, for example, the cemeteries in Skomorochy Małe, Zamość district, and Raciborowice, Chełm district. The cultural individuality of the Strzyżów complexes had not yet been recognised at that time. The separation of the Strzyżów culture took place at the end of the 1950s (Gardawski 1959), and the first monograph, written by Jerzy Głosik, appeared only in 1968.

Jan Kowalczyk, searching for similarities to the materials from Gródek, examined whether the material from the graves could be assigned to the Neolithic Corded Ware culture or the Early Bronze Age Mierzanowice culture (Kowalczyk 1959: 2). Investigating this problem, he compared the "Neolithic Corded Ware" materials from Strzyżów with artefacts from Raciborowice, related to the Mierzanowice culture. This showed that the two groups of material were very similar to each other. Parallel to these findings, Jerzy Głosik (1958a) came to similar conclusions. Then J. Kowalczyk made an attempt to compare this material to the burial ceramics from Mierzanowice. It turned out, however, that the site is culturally heterogeneous – because burials of both the Neolithic Corded Ware culture and Bronze Age Mierzanowice culture coexisted on that cemetery (Kowalczyk 1959: 3–5). Moreover, at that time, the cemetery in Mierzanowice was known only from the initial publication of Kazimierz Salewicz (1937), more attention was paid to it much later (Machnik 1966; Bąbel 1978; 2013; Włodarczak 2006).

J. Kowalczyk conducted comparative studies that allowed him to prove that terms such as "Corded Ware culture" and (especially), "Mierzanowice culture" were ambiguous, therefore they could not be treated as monolithic groups in systematizing the source database . He postulated an acceleration in publication of the source-data from the key burial sites, which would allow the taxonomic and chronological verification of material from the turn of the Neolithic and the Bronze Age. This would result in the redefinition of the conceptual range of cultural units from the beginning of the Bronze Age.

He also formulated the concept of the existence in the Lublin region of a specific group of ceramics with particular, distinct features, for which the term "Strzyżów group of Corded Ware culture" was fully justified (Kowalczyk 1959: 4). This term had been proposed by J. Głosik (1958a: 164). The distinctiveness of this material was manifested, among other things, in a specific treatment of vessels surface by wiping with the use of a straw "brush".

Another important question, raised by J. Kowalczyk in the article titled: *Zagadnienie kultury mierzanowickiej zwanej także tomaszowską* [*The issue of Mierzanowice culture, also known as Tomaszów culture*], is the problem of production and dating of faïence beads (1959: 6–7), in older literature considered as Egyptian imports (e.g. Kozłowski 1928: 28, Kostrzewski 1939–48: 204). He expressed the opinion that the studies, including laboratory analyses, of this type of objects from Poland would allow the establishment of their technological details and – as a result – their origin. Such research, conducted a bit earlier (Clark 1957) for finds from the Balkans and the area of Great Britain, revealed the presence of local European centers of production of the faïence beads. In relation to Polish findings, this postulate was realized only a few years ago and fully confirmed the local production of such jewellery. They were made for specific recipients, using local mineral and plant raw materials, which were natural components in the technological process (Robinson *et al.* 2004; Purowski 2019).

Jan Kowalczyk returned to the issues of the Strzyżów culture and the transition from the Neolithic to the Bronze Age in later publications as a sideline on his Neolithic studies, at the same time repeating the call for intensification of research on that period (Kowalczyk 1961: 36; 1963a: 74; 1968; 1971; 1976: 181–182; 1977). In particular, it is worth mentioning the article titled: *Z zagadnień kultury ceramiki sznurowej* [*The issues of Corded Ware culture*] published in the book: *Liber Josepho Kostrzewski octogenario a veneratoribus dicatus* (Kowalczyk 1968). There he raises, among other things, the question of the specificity of the ceramic products in the Strzyżów culture and at the same time, noticed the similarity of this culture's flint-working to that of the other groups of that time (Kowalczyk 1968: 120–121). The correctness of these observations is proved by the first analytical studies on Early Bronze Age flint production, published about twenty years later (e.g. Kopacz and Valde-Nowak 1987; Budziszewski 1991). He also wrote about the genesis of the Strzyżów culture, which – in his opinion – is *a fairly clear example of migration from the north* (Kowalczyk 1968: 121). According to J. Kowalczyk, this was indicated by the technique of surface treatment of the vessels, for which he saw analogies in the forest zone. This hypothesis, however, did not find adherents in later times. It was not supported by the material evidence or developed in subsequent monographic studies.

Since the publication of the above-mentioned works by Jan Kowalczyk, in which he appealed for an intensification of research on the beginnings of the Bronze Age, views on these issues have changed radically (see Kadrow 2000; Machnik 2000). This

is mainly due to the increase in the source data, also for the Lublin region (Machnik *et al.* 2009; Bargieł *et al.* 2012), closest to the interests of this researcher. The issues of taxonomy and chronology of the early phase of the Bronze Age were successively studied and published, mainly by Jan Machnik. The first works, which redefine the nature of the turn of the Neolithic and Bronze Age in the areas of south-eastern Poland, were published in the 1960s (Machnik 1960; 1963; 1967). The new approach proposed by this researcher, reflecting the evolution of the Corded Ware culture, was related to the separation of – on the one hand – the Chłopice-Veselé group/culture[1], and – on the other – the Circum-Carpathian Epi-Corded Cultural Circle (Machnik 1967) as part of the Central European Early Bronze Age civilisation. Jan Machnik established this opinion in the 1970s (Machnik 1972; 1977; 1978).

In the last 25 years, the research on the beginnings of the Bronze Age in the Polish lands has been experiencing a tremendous growth. This also applies to the areas of southern Poland, where communities of Epi-Corded cultures functioned. The issues were studied further by J. Machnik, but were also examined by other archaeologists, including Sławomir Kadrow (Kadrow 1994; 1995) and lately Paweł Madej (2016; 2017). A summary of the state of research on the Mierzanowice culture, including the state of the source basis in the mid-1990s, is the book entitled: *Kultura mierzanowicka. Chronologia, taksonomia i rozwój przestrzenny* [*Mierzanowice culture. Chronology, taxonomy and spatial development*] (Kadrow and Machnik 1997).

At the same time, republishing of the material from old excavations and recent studies on the Strzyżów culture settlements and cemeteries, as well as the possibility of obtaining a series of radiocarbon dates, allowed for its more precise dating within the Early Bronze Age (e.g. Ślusarski and Ślusarska-Polańska 1988; Banasiewicz 1990; Bargieł 2006; Hyrchała 2005a; 2005b; Włodarczak 2017).

The intensification of field studies, especially extensive excavation work in advance of large road developments, has led in the present century to constant corrections in the picture of the Neolithic and the beginnings of the Bronze Age in the Polish lands. This picture has already been presented by the latest synthetic publications (Włodarczak ed. 2017; Bugaj ed. 2017). However, the full analysis of these valuable source data has not been completed yet, and subsequent publications – which appear every year (e.g. in the series *Via Archaeologica Ressoviensia*) – will probably soon result in the need for further verification.

Translated by Tomasz Myśliwiec

[1] This idea found the acceptance of J. Kowalczyk (Kowalczyk 1963b). Machnik himself later withdrew this idea (Machnikowie and Kaczanowski 1987: 103–107, Machnik 1989).

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Interest of Jan Kowalczyk in the Mining of Flint Raw Materials

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Jan Kowalczyk exhibited great interest in the issues related to the prehistoric acquisition of flint raw materials and their working. He was involved in research and conservation issues at the turn of the 1950s and 1960s in the Neolithic and Early Bronze mines of banded flint in Krzemionki Opatowskie, exploited by communities of the Funnel Beaker, Globular Amphorae and Mierzanowice cultures. In 1967 and 1970 he was an inspirer and co-participant of Bogdan Balcer's research within the Świeciechów-type flint deposits in Świeciechów, near Annopol. The raw material was mined here using open-pit methods, constituting the oldest form of mining. The mines were at the same time centres of mass flint production. Świeciechów flint was used from the Paleolithic period throughout the Neolithic to the Bronze Age.

KEY-WORDS: Neolithic, Funnel Beaker culture, Globular Amphora culture, Early Bronze Age, Mierzanowice culture, prehistoric mining, banded flint, Krzemionki Opatowskie, Świeciechów flint, Świeciechów, flint workshops.

Jan Kowalczyk worked in the State Archaeological Museum in Warsaw (PMA) in 1954–1972. He was employed as the Head of the Neolithic Department, and in the last two years – as Deputy Director for Research. He created an outstanding team with such researchers of the Neolithic as: Elżbieta Kempisty, Bogdan Balcer, Anna Uzarowicz-Chmielewska and Jerzy Głosik. He was the initiator of various scientific activities and excavation campaigns on the Sandomierz Upland, Lublin Upland, in the Masurian Lake District, Mazovia and Podlasie. The publications of the members of this team have not lost their relevance until today and are among the leading works in the literature devoted to the Neolithic in Poland. The approach of J. Kowalczyk to his employees was best expressed by B. Balcer – *I always say that docent Jan Kowalczyk has guided me "from student to docent". In the profession I owe him as much as to my parents in life* (Balcer 2015: 134).

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Jan Kowalczyk is the author of one of the most important studies concerning the beginnings of the Neolithic period in Poland (1969), which initiated a dynamic discussion among Stone Age researchers. These resulted in articles by E. Kempisty and Jan Gurba (1971), Janusz Krzysztof Kozłowski (1971) and B. Balcer (1971b). B. Balcer emphasized that J. Kowalczyk, as one of the few researchers in the mid-twentieth century, recognized the research on Neolithic flint working as an important item in the synthetic work concerning the Later Stone Age (Balcer 1971b: 51).

J. Kowalczyk exhibited great interest in the issues related to obtaining flint raw materials in the Neolithic in the territory of Poland. He was involved in scientific problems, conservation and public presentation of matters related to the prehistoric flint mines in Krzemionki Opatowskie, Ostrowiec Świętokrzyski district (Fig. 1), exploited by the Neolithic communities of the Funnel Beaker culture (FBC), Globular Amphora culture (GAC) and – marginally – Early Bronze Age Mierzanowice culture (Borkowski *et al*. 1989: 201–207). During the research conducted in the complex of mines in Krzemionki Opatowskie, at the end of the 1950s, he collaborated with Tadeusz Żurowski from the Ministry of Culture and Art, as well as with J. Gurba from the Maria Curie-Skłodowska University in Lublin, Andrzej Kempisty from the University of Warsaw and Zygmunt Krzak from the then Institute of the History of Material Culture (currently the Institute of Archaeology and Ethnology) of the Polish Academy of Sciences – IAE PAN (Lech 1999: 71). B. Balcer has repeatedly mentioned that he owes his work on Neolithic flint working to J. Kowalczyk, who also contributed to his participation in the research of T. Żurowski in Krzemionki Opatowskie in 1961 (Balcer 2014: 109). During this period, archaeological work was concentrated in an area of workings of the pillar-chamber mines, No. 2 and 3, feature No. 1 was back filled by T. Żurowski due to strong destruction (Sałaciński 1997: 20). This had been initially cleared of debris by Stefan Krukowski in the 1920s and 1930s, though only brief interim reports ever appeared (Krukowski 1939: 118–120). In addition, the team of T. Żurowski explored the shaft and workings of the chamber mine No. 4 (Żurowski 1961: 28).

The research work in Krzemionki Opatowskie in the 1950s, in which J. Kowalczyk participated, was summarized by T. Żurowski in an article which presented the conservation aspects, a description of mining pits and the discovered artefacts; an attempt was made to pre-characterize the mines and to undertake a taxonomic analysis (Żurowski 1960).

J. Kowalczyk was a co-author (along with B. Balcer, J. Głosik and Zdzisław Rajewski) of the scenario of an exhibition devoted to prehistoric mining, realized in 1968 (Rajewski 1971: 21). Issues related to Krzemionki Opatowskie, mining and flint production found their place in the popular science book by J. Kowalczyk, *Zmierzch epoki kamienia* [*The Twilight of the Stone Age*] (1971). He described in it an exploitation field with perfectly preserved post-mining surface relief in the form of funnel-shaped openings of underground shafts and heaps of limestone debris surrounding them, putative

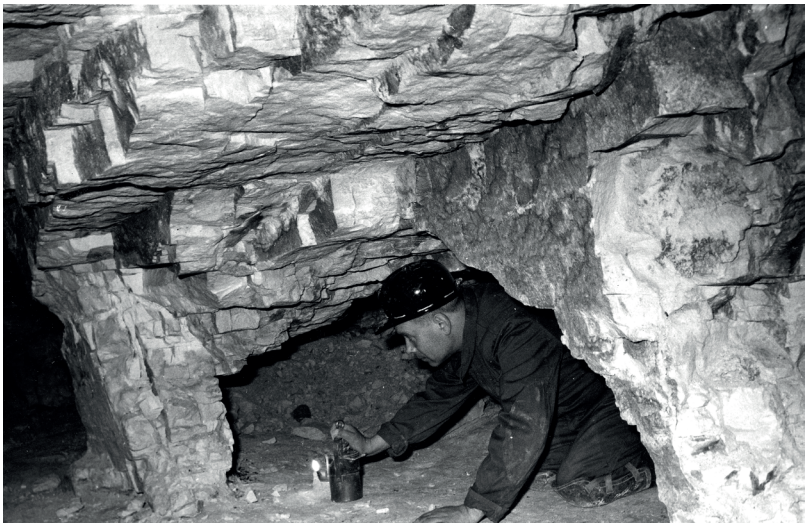

Fig. 1. Jan Kowalczyk in the underground in the mines in Krzemionki Opatowskie, Ostrowiec Świętokrzyski district. Photo: D. Kostkowski, PMA Archive.

mining and flint working techniques, as well as modern destruction of mines (Kowalczyk 1971: 85–91).

J. Kowalczyk was also a co-author of one of the concepts for the management of the Krzemionki reserve. The assumptions of this study included preliminary plans for the creation of a museum centre in Krzemionki with exhibitions devoted to the prehistoric flint mining, storage rooms for the collections and a research station with workrooms and housing facilities. It was to be located beyond the outskirt of the mines, in the place of buildings of the former Krzemionki village (Balcer 2015: 144). It was also planned to conduct archaeological research on the exploitation field.

In accordance with the above-mentioned project, in the years 1969–1970 J. Kowalczyk directed, in cooperation with B. Balcer and Z. Krzak, archaeological excavations in the area of mine No. 5 in Krzemionki Opatowskie (Fig. 2). One of the main research objectives was to determine the state of preservation of the mines in this area of the exploitation field. These works were also aimed to establish an appropriate methodology of exploration, allowing to study the stratigraphy as well as the scatter pattern of waste dumps, shaft fillings and flint workshops situated within the area of the mines (Balcer 1996: 172). The study covered the area of 28 × 15 m. After cleaning the surface of the vegetation, a backfilled shaft in a funnel form with surrounding waste heaps was uncovered (Fig. 3, 4). The trench marked out in 1969 had dimensions 5 × 6 m, in 1970

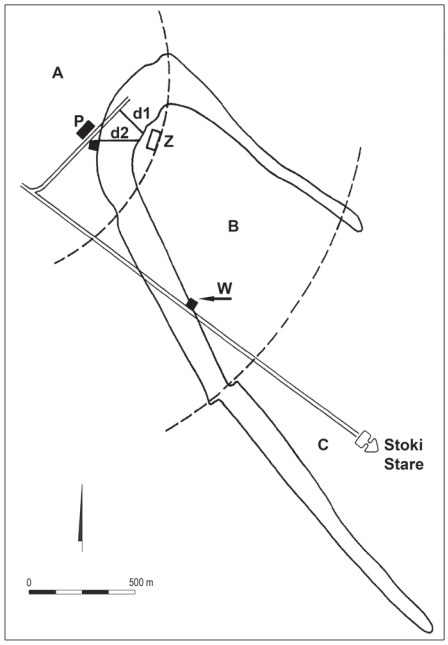

Fig. 2. Krzemionki Opatowskie, Ostrowiec Świętokrzyski district. Location of the research area of the mine No. 5. A, B, C – segments of exploitation field; Z – the farmhouse of J. Pachniak and the later base of the expedition; P – pavilions from 1969; W – location of the trench from 1969–1970; d1 – the approach road to J. Pachniak's farm; d2 – the approach road to the expedition base. Location of the excavation. According to B. Balcer 1996, Fig. 1, revised. Graphic design: B. Sałacińska.

it was expanded by 1 m and reached the dimensions of 6 × 6 m. It was divided into four quadrants (A–D).

During the exploration, the outlines of three flint workshops, defined as clusters (Fig. 3), were partially discerned. In two of them axe roughouts and blanks were shaped, and they were finished in the other. The workshops were located north, south-east and south-west of the shaft, at a depth of 80–100 cm. In the first cluster, 1100 flint artefacts were discovered, in the second – over 500, in the third – 300 (Balcer 1996: 179, Fig. 6, 7). In total, more than 3000 flint artefacts were found, mainly flakes, industrial chunks, unworked fragments of flint, and pre-cores. A few core forms, splintered pieces and retouched tools were identified as well as three tools made from antlers: two from deer antlers, one from elk (Fig. 5). Most of the artefacts (75%) came from the quarter A (Fig. 6), 20% – from D, 5% – from B (Balcer 1996: 179).

Under the waste heap, at a depth of about 90 cm, fragments of the outline of a mine shaft were uncovered (Fig. 3), which probably had dimensions of 360 × 420 cm (Balcer 1996: 182). The exploration was completed at a depth of approximately 100 cm.

B. Balcer attributed the acquired material to the Lesser Poland industry of the FBC or to the gierecki industry of the GAC. A detailed description of the research results, including stratigraphic data, scatter patterns, analysis of artefacts, the taxonomic determinations of the finds, were included in the study cited above (Balcer 1996). At the

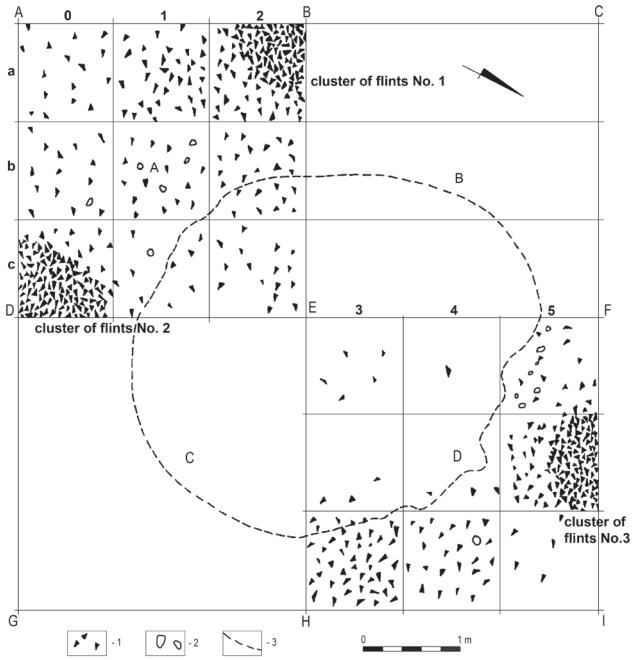

Fig. 3. Krzemionki Opatowskie, Ostrowiec Świętokrzyski district. Outline of the mine No. 5 and location of clusters of flint at a depth of 80–100 cm. 1 – flints; 2 – stones; 3 – limit of the shaft outline. According to B. Balcer 1996, Fig. 7, revised. Graphic design: B. Sałacińska.

time of writing of this article, the fates of the artefacts obtained from the 1969–1970 season were not known. Searches executed in the PMA and IAE PAN collections and in the available assemblages from the Historical and Archaeological Museum in Ostrowiec Świętokrzyski and the Archaeological Reserve in Krzemionki Opatowskie unfortunately did not give positive results.

J. Kowalczyk was also an inspirer of B. Balcer's research in the area of the Świeciechów-type flint mines in Świeciechów, Kraśnik district (Fig. 7), which were discovered in 1923 by Jan Samsonowicz (Samsonowicz 1924). In 1963, Z. Krzak (1965) recognized the surface evidence of the exploitation area of the Świeciechów raw material. Excavation work was preceded by multiple surveys of the area of the Turonian flint deposits near Annopol, Kraśnik district carried out by B. Balcer and J. Kowalczyk. The research was conducted on behalf of PMA in the years 1963–1967 as part of the Neolithic settlement recognition program on the edge of the Sandomierz Upland (Balcer 1971a: 71–72). Their main purpose was to determine the stratigraphy of the

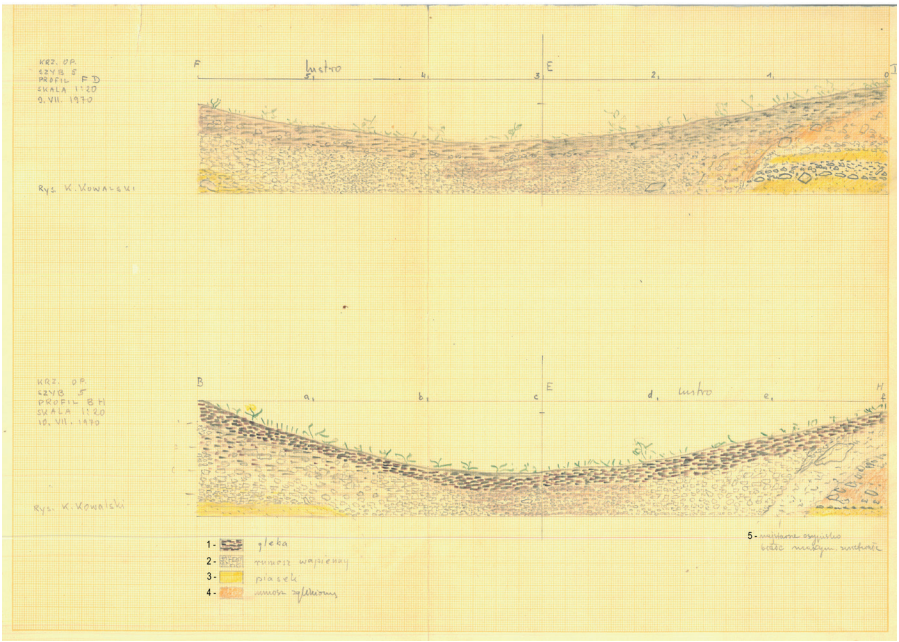

Fig. 4. Krzemionki Opatowskie, Ostrowiec Świętokrzyski district. Profiles of the trench within mine No. 5 with visible depression of the shaft, 1970. 1 – humus; 2 – limestone rubble; 3 – sand; 4 – clay with limestone rubble; 5 – the oldest talus deposit; Z. 1 – depression No. 1. Drawing: K. Kowalski, PMA Archive.

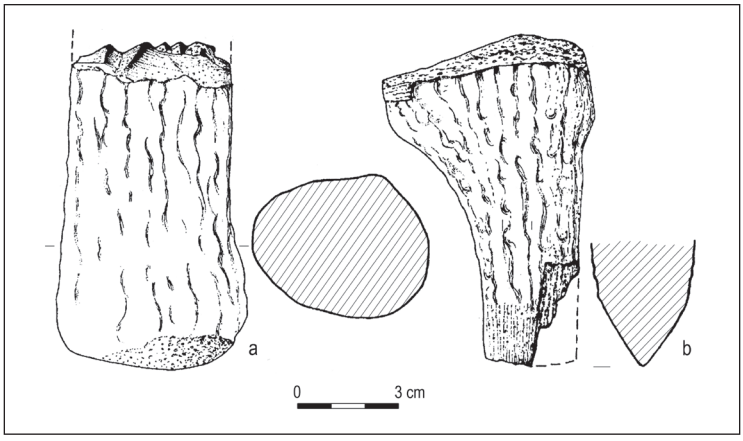

Fig. 5. Krzemionki Opatowskie, Ostrowiec Świętokrzyski district. Fragments of mining tools of antler discovered during the research of mine No. 5. A – a toothed tool from a mallet; b – wedge. According to B. Balcer 1996, Fig. 9, revised. Graphic design: B. Sałacińska.

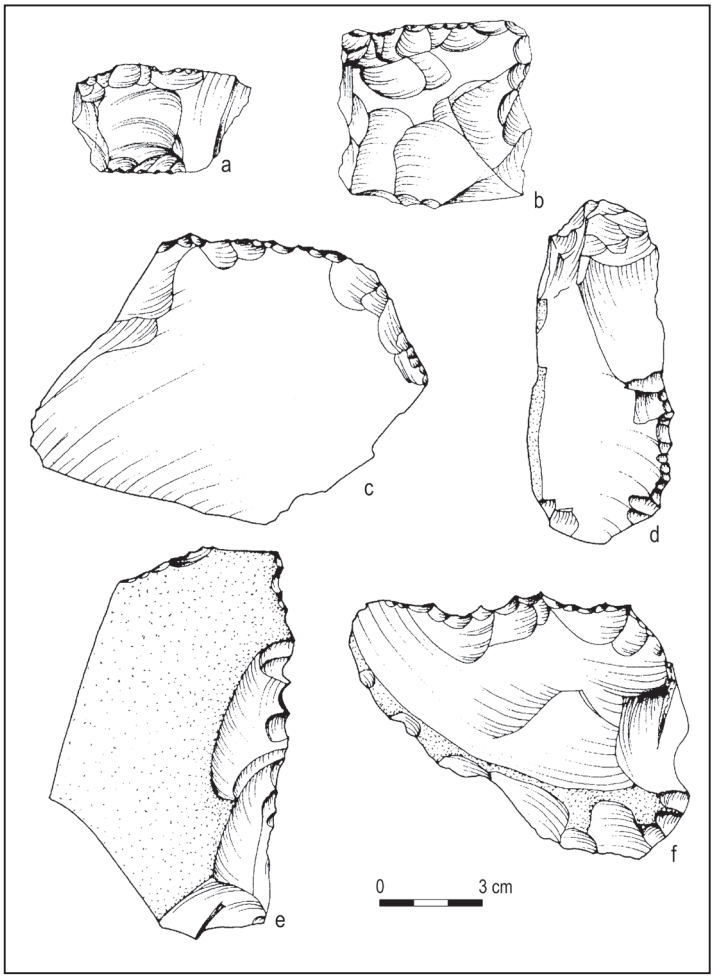

Fig. 6. Krzemionki Opatowskie, Ostrowiec Świętokrzyski district. Finds of banded flint from research in mine No. 5 a, b – splintered pieces; c – a sidescraper; d – retouched blade-flake; e, f – toothed tools. According to B. Balcer 1996, Fig. 8, revised. Graphic design: B. Sałacińska.

grey, white-dotted Turonian flints raw materials originating from the right-bank deposits on the Rachów anticline (Balcer 1975: 46, 149), to reconstruct their exploitation methods and determining – based on production residues – the relationships of the mines with local settlements (mainly with the settlement in Zawichost, site "Pieczyska–Zbrza Wielka", Sandomierz district and with the settlement in Ćmielów, site "Gawroniec", Ostrowiec district).

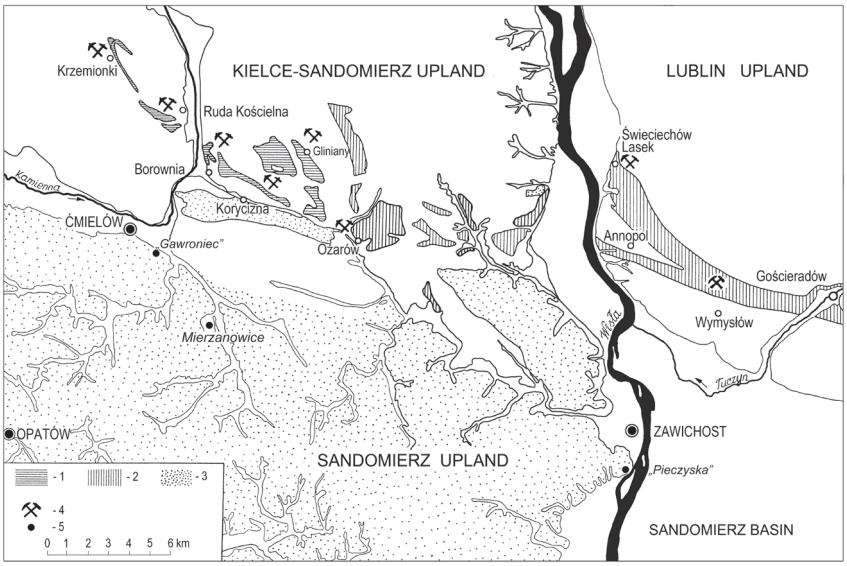

Fig. 7. Location of the Świeciechów flint mines within the eastern Łysogóry region of prehistoric mining. 1 – Astart; 2 – Turon; 3 – loess; 4 – flint mines; 5 – main settlement points. According to B. Balcer 1971b, Fig. 1, revised. Graphic design: B. Sałacińska.

Fig. 8. Świeciechów, Kraśnik district. Excavation in 1967. Photo: PMA archive.

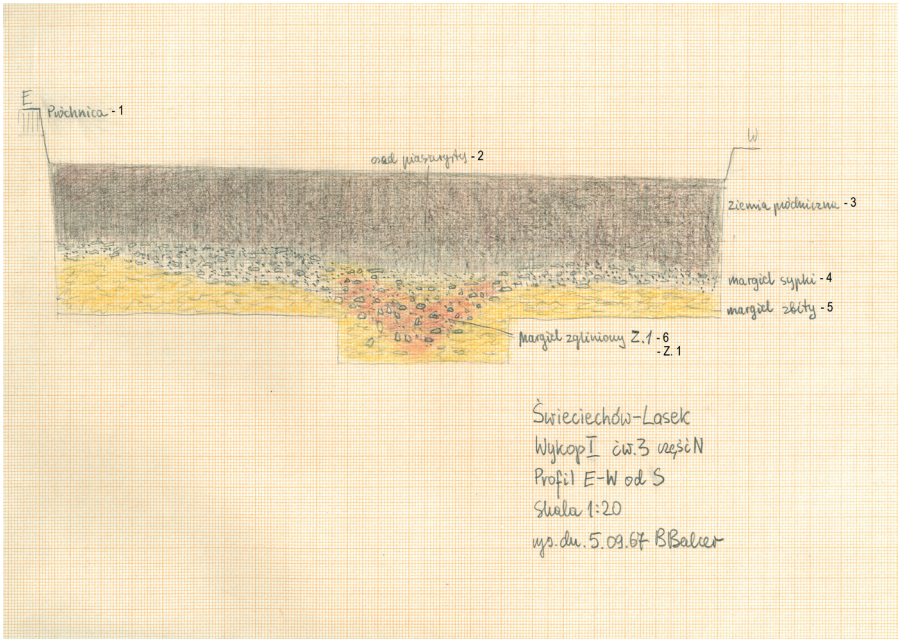

Fig. 9. Świeciechów, Kraśnik district. Profile of trench I, 1967. 1, 3 – humus; 2 – sand; 4 – limestone dust; 5 – limestone rubble; 6 – clay with limestone rubble. Drawing: B. Balcer, PMA Archives.

J. Kowalczyk was also the author of a program of an exploratory research and test excavations in the area reaching from Sandomierz to Świeciechów, measuring approximately 15 × 35 km, with a surface of 525 km² (Kowalczyk 1962a: 302). Its initial implementation started in 1962. The research team was composed of J. Kowalczyk, B. Balcer and E. Kempisty. The area penetrated have been the so-called "Góry Pieprzowe" [Pepper Mountains] near Sandomierz, the edge of the Opatówka valley on the section from Kichary to Dwikozy, the edge of the Sandomierz Upland between Dwikozy and Zawichost and the flint mines in Świeciechów (Kowalczyk 1962a: 303–304).

In 1967 and 1970 B. Balcer, assisted by J. Kowalczyk, carried out test excavations at a mine site in Świeciechów (Fig. 8, 9). The results of the work allowed to assess that the flint in the area of Świeciechów was acquired using the open-pit method, which is the oldest form of mining. In the test trenches in the western part of the site, *slight traces of depressions with rounded bottoms were found. They cut the weathered layer up to the level of 55–85 cm, originally being probably deeper. The depressions were 80–120 cm wide, and their length documented in the trenches was up to 160 cm* (Balcer 2002: 24). B. Balcer considered them to be traces of the lower parts of opencast exploitation

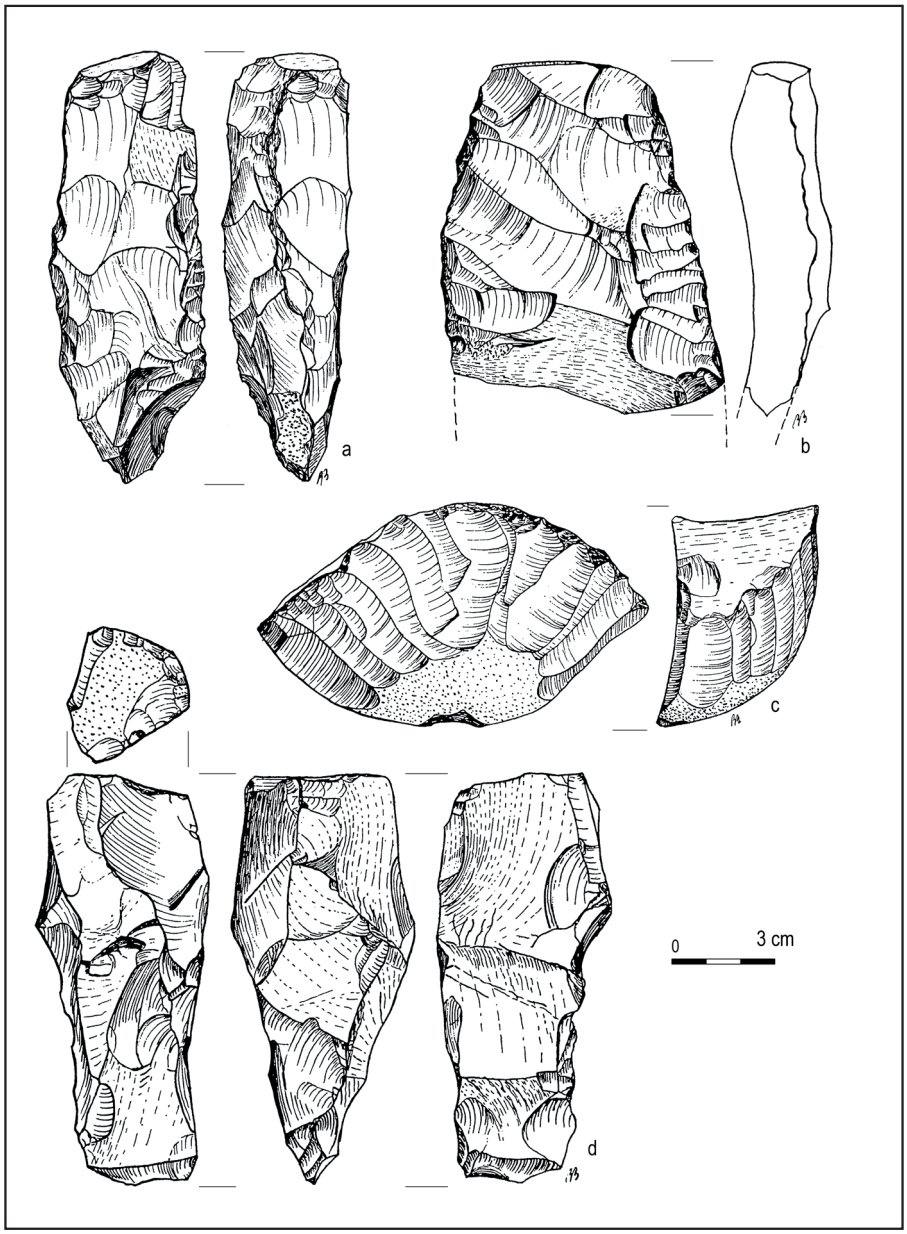

Fig. 10. Świeciechów, Kraśnik district. Artefacts of Świeciechów flint. a, d – picks, b – fragment of a tetrahedral axe blank; c – a blade core. Drawing: B. Balcer. According to B. Balcer 1971, Table I, revised. Graphic design: B. Sałacińska.

excavations in the form of oval pits or longitudinal trenches, next to which the workshops of preliminary flint processing were located (1971a: 91–92; 1975: 162; 2002: 24). The mines were at the same time centres of mass flint production, as evidenced by the accumulation of waste from various production phases, mainly from the initial stages of shaping products (Balcer 1975: 177). In the inventory recovered from Świeciechów, unfortunately, as many as 90% were unworked fragments of flint, and only 10% – flints with traces of working, including 6% – core forms: pre-cores, flake and blade cores, tool preforms (Balcer 1971a: 95–108, Table I–XIII). The Świeciechów raw material was used from the Paleolithic to the Bronze Age (Balcer 1971a: 122–129; 1975: 158). In the flint material from this site, B. Balcer distinguished products belonging to the Late Paleolithic, Mesolithic, Neolithic Danubian cultures, FBC, GAC (Fig. 10, 11) and the Early Bronze Mierzanowice culture (Balcer 2002: 24). To the artefacts of the Lesser Poland industry of the FBC, he included the roughouts and blanks of tetrahedral axes and production residues of exquisite macrolithic blades and cores. Neolithic miners were thought to have lived in the settlement in Zawichost, at the site "Pieczyska–Zbrza Wielka", and reaching the source of the raw material and its transport could be enabled by the Vistula. The industrial character of the settlement was described by B. Balcer on the basis of the mass processing of the Świeciechów flint in its area (Balcer 1968: 355).

J. Kowalczyk was undoubtedly a researcher who was also a synthetist. Prehistoric mining and flint working were only two of his many interests in researching the Neolithic. As one of the basic issues, he recognized the analysis of complexes of evidence referred to as archaeological cultures, groups or cycles (Kowalczyk 1969: 6). In his studies, he addressed the fundamental aspects of the Neolithic, for example, its definition, genesis, chronology. He emphasized the significance of comparative studies, developmental regularities, and ethnic problems (Kowalczyk 1962 b: 272). Some of his views in this regard met with criticism, but many remain still valid.

Translated by Andrzej Leligdowicz

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Podlesie, Site 6 – the First Obsidian Inventory of the Linear Pottery Culture Communities from the Połaniec Basin

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The article includes the presentation and preliminary characterisation of the obsidian inventory obtained during the five research seasons (2014–2018) at the site in Podlesie, Staszów district, Świętokrzyskie voievodship. Currently, it is one of the largest collections of artefacts of this raw material related to the Linear Pottery culture (104 examples), and at the same time the first obtained from the Połaniec Basin mesoregion. In the light of the current state of research, it is also one of the few inventories of this culture (outside the Rzeszów settlement cluster), in which the share of obsidian exceeded 4%. Its homogeneous nature and large size, as well as the obtained radiocarbon dates, to a very significant extent supplement the current knowledge about the initial phase of the Neolithic obsidian influx into the Upper Vistula basin area, at the end of the 6th millennium BC.

KEY-WORDS: Linear Pottery Culture, music-note and Želiezovce phases, radiocarbon data, obsidian, processing, Upper Vistula basin.

INTRODUCTION

The inflow of obsidian into the areas on the northern side of the Carpathians and Sudetes is documented for the Older and Middle Stone Age (e.g. Kostrzewski 1930: 95–96; Biró 1985: Fig. 1; Ginter 1986; Szeliga 2002; Hughes *et al.* 2018). The greatest intensity of this phenomenon, however, took place in the Neolithic period, closely tied with the Danubian cultural groups, which maintained intensive contacts with the Transcarpathian zone throughout the whole period of its development. In the light of the current state of knowledge, the Neolithic import of obsidian into the Vistula and

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Oder river basins lasted almost continuously from the end of the 6th to about the middle of the 4th millennia BC, with a varying degree of intensity and involving a various forms of inflow (e.g. Kozłowski 1970: 89; Kaczanowska 1980; 1985: 65; Szeliga 2007; 2009; Wilczyński 2010). Particularly interesting is the initial phase of this phenomenon, taking place during the development of the Linear Pottery culture (hereinafter LBK) and by far represented by the largest number of inventories, which also represent the most extensive range of territorial spread (Szeliga 2009: Fig. 1; tab. 1). This article, including the presentation and preliminary characterisation of the first so-dated obsidian inventory from the Połaniec Basin, is a small but quite significant contribution to the study of the whole phenomenon of the inflow of this exotic material and its processing by the early agricultural communities settled in the Upper Vistula basin at the end of the 6th millennium BC.

THE INFLOW OF OBSIDIAN DURING THE LBK DEVELOPMENT

The Neolithic inflow of obsidian into the areas located to the north of the Carpathians was initiated in the classical (music-note) phase of the LBK, and intensified in the late – Želiezovce stage of its stylistic development (e.g. Kaczanowska 1971: 12–13; 1976: 38; Godłowska 1976: 91–92; Kulczycka-Leciejewiczowa 1979: 85; Kadrow 1990a: ryc. 24: a–i; 26: c; Szeliga 2007: Abb. 1; 2009: 298–304). Currently several dozen sites dated to this period are known in those areas, where the products made of this raw material have been found. The vast majority of them create a several distinct clusters in the upland loess zone of southern and south-eastern Poland (Przemyśl, Rzeszów, Targowisko and Brzezie, Cracow-Nowa Huta and Sandomierz regions). Less numerous are sites located outside this area, sometimes at a very large distance from it (Szeliga 2009: Fig. 1).

Despite the large number of inventories (territorially scattered), the amount of obsidian products is generally small, ranging from a single specimens to several dozen examples (Szeliga 2009: tab. 1). Only few sites from the Upper Vistula basin have provided assemblages containing over a dozen pieces (e.g. Rzeszów, site 16, Brzezie, site 17; see Kadrow 1990a: 33; Wilczyński 2014: 500), and even over 200 artefacts (e.g. Cracow-Olszanica, site 4; see Milisauskas 1983: tab. 4). Regardless of the size of particular inventories, the percentage of obsidian in the structure of their raw material is usually very low and does not exceed 2–3%, and only sporadically reaches higher values (e.g. Kozłowski 1970: tab. I; Godłowska 1982: 153; Milisauskas 1986: 145; Kaczanowska *et al.* 1987: 94; Michalak-Ścibior and Taras 1995: tab. V; Wilczyński 2014: tab. 2). This points to the minimal, practically irrelevant importance of this material for production, and thus – to its inflow into particular settlements without economical justification. Only some of the inventories of the material from the Rzeszów settlement cluster

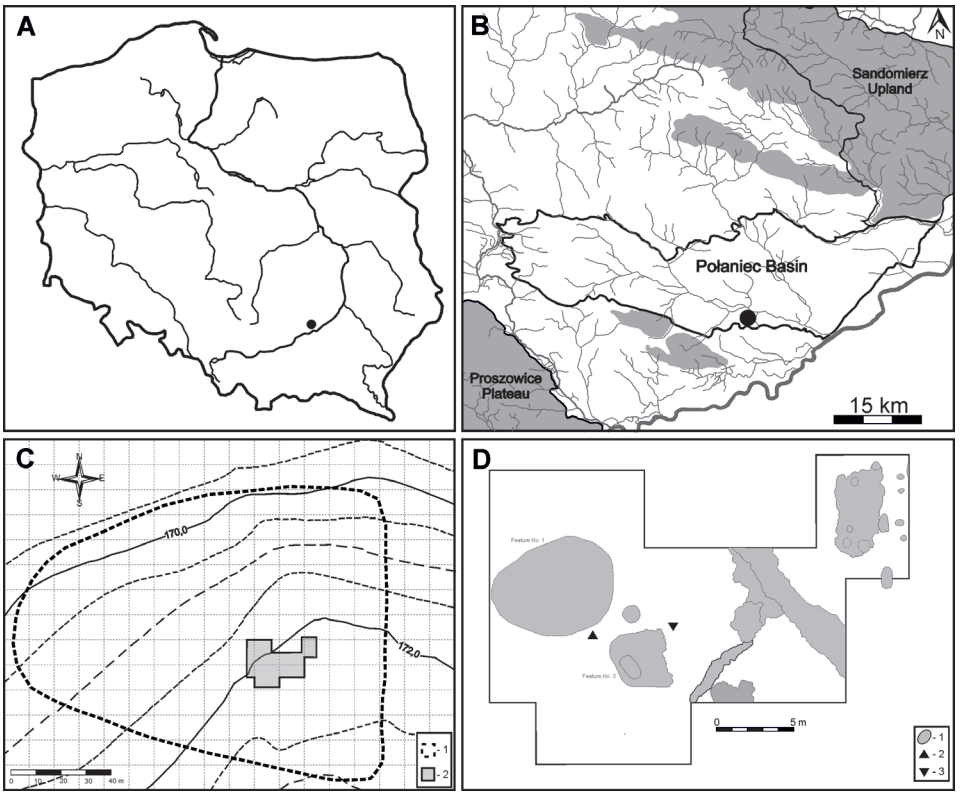

Fig. 1. Podlesie, site 6. Analysed area: A – general location of the site; B – location of site within the Połaniec Basin (by Kondracki 2002); C – the extent of the site in the context of the site grid (1) with area excavated in 2014-2018 (2); D – location of LBK features (1) and dated ceramic samples (2 – sample PDL6_A; 3 – sample PDL6_B); features No. 1 and 2 – features with obsidian artefacts. Prepared by A. Grabarek and M. Szeliga.

deviate from this situation. In these, the percentage of obsidian exceeds many times the values known from other areas and keeps a high frequency throughout the entire LBK development period (e.g. Kraczkowa, site 1, Rzeszów, sites 16 and 34, Zwięczyca, site 3; see Kulczycka-Leciejewiczowa 1979: tab. 5, ryc. 26; Kaczanowska 1985: Abb. 22; Kadrow 1990a: Fig. 24a–e; 26c; 1990b: Fig. 14a–c; Pelisiak 2014: tab. 14). These data indicate a completely different significance of the obsidian in local processing, justifying the perception of local LBK communities as one of its most important recipients and users, most likely mediating and controlling its redistribution to more remote settlement centres (Szeliga 2009: 298–299).

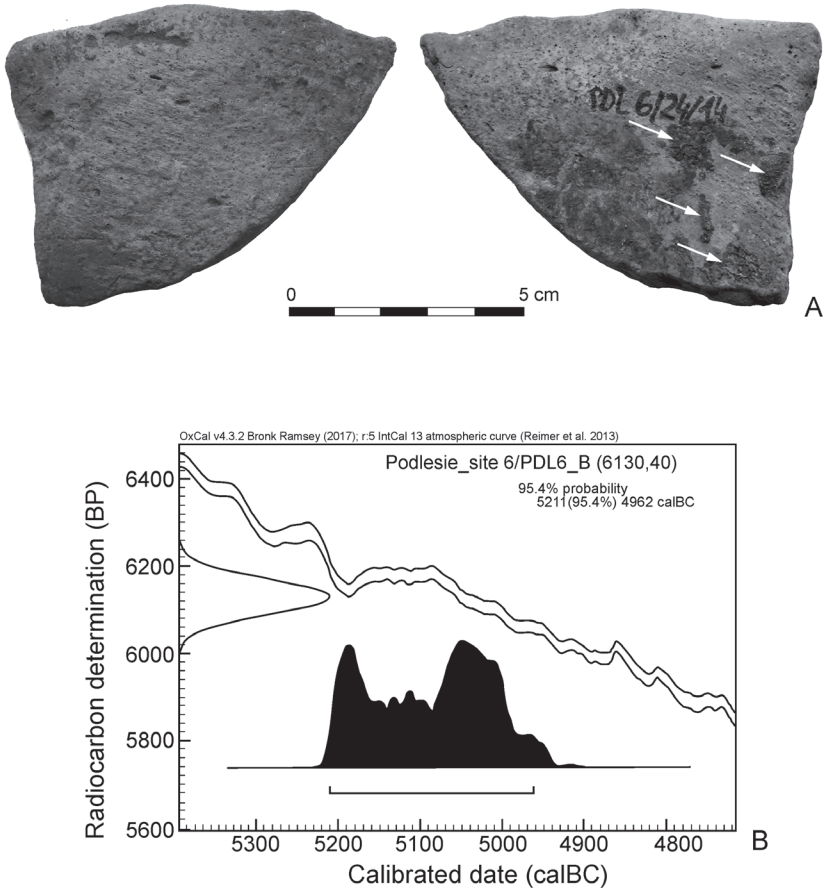

Fig. 2. Podlesie, site 6. Fragment of a LBK vessel with preserved organic substance – sample PDL_B (A) and the calibration curve of 14C date obtained on its basis (B). Prepared by M. Szeliga.

The current analysis of the findings indicates that obsidian was flowing into the southern Poland LBK settlement centres in the form of natural concretions (e.g. Kozłowski 1970: 89; Godłowska 1982: 92; Kaczanowska 1985: 65; Szeliga 2009: 303). Although the results of previous chemical analyses confirm the presence of products made of both Slovak (*Carpathian 1*) and Hungarian (*Carpathian 2*) varieties of this raw material in such dated inventories (Milisauskas 1983: 172; 1986: tab. 92), it seems that the obsidian from the Slovak outcrops was the most important. This is indicated by the recent results of the Prompt Gamma Activation Analysis, carried out for a series of products

from Kuyavia and Podkarpacie, allowing identification of the origin of the raw material with the areas near Cejkov and Kašov in south-eastern Slovakia (Kabaciński *et al.* 2015: 10–12). They correspond to the results of geochemical analyses of obsidian artefacts originating from Czech inventories (Burgert *et al.* 2016: Obr. 4–5), as well as the findings of A. Přichystal and P. Škrdla (2014: 224), justifying the location of the most important obsidian outcrops exploited in prehistory in a small area between Brehov, Cejkov and Zemplín.

In the context of the presented data, the collection obtained in recent years on the site 6 in Podlesie, Staszów district, Świętokrzyskie voievodeship clearly stands out. It is currently one of the largest LBK obsidian inventories (104 artefacts), and the first one obtained by excavation in the Połaniec Basin. The large number of items and presumably homogeneous nature, as well as the possibility of precise dating of this collection make this assemblage quite unique in the context of other LBK findings and inventories known from the Upper Vistula Basin.

THE LBK SETTLEMENT IN PODLESIE

Site No. 6 in Podlesie is located in the central part of the Połaniec Basin, a part of the Małopolska Upland (Kondracki 2002: 269–270). It occupies a fragment of the southern, gentle slope and the edge of the Wschodnia river valley (Fig. 1A–C). It is based on Pleistocene clays from the Sanian and Odranian glaciations and diluvial sediments covering the Miocene Cracow loams. The current soil cover is formed by lessive soils. Based on the results of surface and geophysical surveys, as well as drilling, the size of the site is estimated at about 2 ha (Fig. 1C).

The site was accidentally discovered in 2009 by one of the villagers. Since 2014, it has been the subject of systematic excavations under the direction of Artur Grabarek from the Institute of Archaeology at the University of Warsaw. So far, a total area of 3.8 ares has been examined, where 10 immobile features were discovered and explored. The research was carried out manually, with the use of hoes, and the feature fills were partially floatated or screened. The research methodology applied allowed a very large collection of artefacts to be obtained. These finds consist of a total number of approximately 14.500 products of various categories, mainly ceramics, and to a lesser extent flint artefacts (Przeździecki *et al.*, in print). All features and all artefacts are related to the LBK. The analysis of technological features and stylistics of the ceramic's ornamentation allows for the chronological location of the whole collection at least between the classical section of the music-note phase and the early stage of the Želiezovce phase (i.e. NII – ŽI; see Pavúk 1969: 275–277; Kadrow 1990a: 62), with a clear quantitative dominance of materials decorated in classical and late music-note style. This classification corresponds very well with the occurrence of single fragments of vessels deco-

rated in the manner typical for the Eastern-Linear groups, mainly for the Kapušany--Tiszadob group and the Bükk culture (Przeździecki *et al.*, in print).

CHRONOLOGICAL DATA

The site's absolute chronology was determined on the basis of two organic samples, macroscopically similar to birch tar (Fig. 2A), obtained from two diagnostic fragments of thin-walled LBK vessels, originating from the cultural layer in different parts of the excavation trench from a depth of about 80 cm, in the vicinity of feature No. 2 (Fig. 1D). Both samples were dated using the AMS technique at the Poznań Radiocarbon Laboratory. The following dates were obtained: a/ 4710 ± 50 BP; b/ 6130 ± 40 BP (Tab. 1, Fig. 2B). The first of these dates should be rejected as definitely too late for LBK, presumably because of the organic matter contamination or from the small content of carbon (Tab. 1). The second date would fall in the chronological frames defined for the LBK music-note phase in south-eastern Poland (Czekaj-Zastawny 2008: 116). This date therefore documents the settlement of the site by communities of this culture, as well as the inflow and use of obsidian resources at least at the end of 6th millennium BC (Fig. 2B). It also corresponds with radiocarbon dates of obsidian inventories originating from various settlement centres of this culture, in the Rzeszów area (Zwięczyca, site 3, feature No. 36; see Dębiec 2014: 107–108; Pelisiak 2014: tab. 21), as well as in the Cracow region (Brzezie, site 17, features No. 238 and 377; see Czekaj--Zastawny 2008: tab. I; Wilczyński 2014: tab. 3) and Sandomierz region (Tominy, site 6, feature No. 108; see Szeliga 2017: tab. 1, Fig. 6: 3).

OBSIDIAN INVENTORY

The assemblage presented here of obsidian products contained a total number of 104 artefacts, constituting about 4.79% of the whole raw material structure of the lithic inventory (Fig. 3A). The vast majority of them were discovered within non-feature cultural layers, and 31 specimens during the exploration of the features No. 1 (17 pieces) and No. 2 (14 pieces). In spite of the context of most of the finds, their relation to the LBK is not in doubt, due to the homogeneous nature of all historical materials (including ceramics) obtained from the site during the previous research.

The analysed products reveal a considerable degree of differentiation of their macroscopic properties, above all the colour and transparency. By far, the most numerous group are artefacts made of black material, often in material with a streaked internal structure, translucent only in the thinnest, edge parts. They are complemented by much less numerous specimens made of a transparent material of grey or grey-black

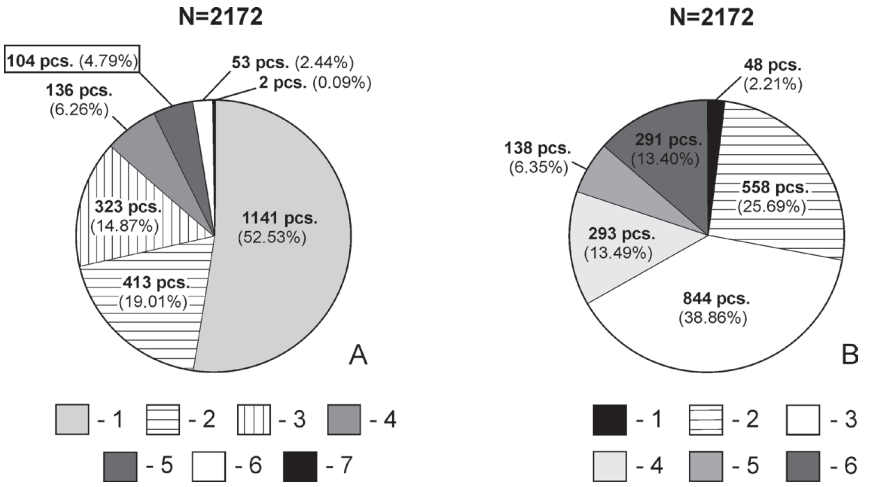

Fig. 3. Podlesie, site 6. Cumulative structure of flint and obsidian artefacts obtained in 2014-2018 (after Przeździecki *et al.*, in print): A – raw material structure (1 – Jurassic-Cracow flint; 2 – Świeciechów flint; 3 – Chocolate flint; 4 – Undefined (burned) flint; 5 – Obsidian; 6 – Erratic flint; 7 – Banded flint); B –morphological structure (1 – cores; 2 – blades and their fragments; 3 – flakes; 4 – chips; 5 – sherds; 6 – retouched tools).

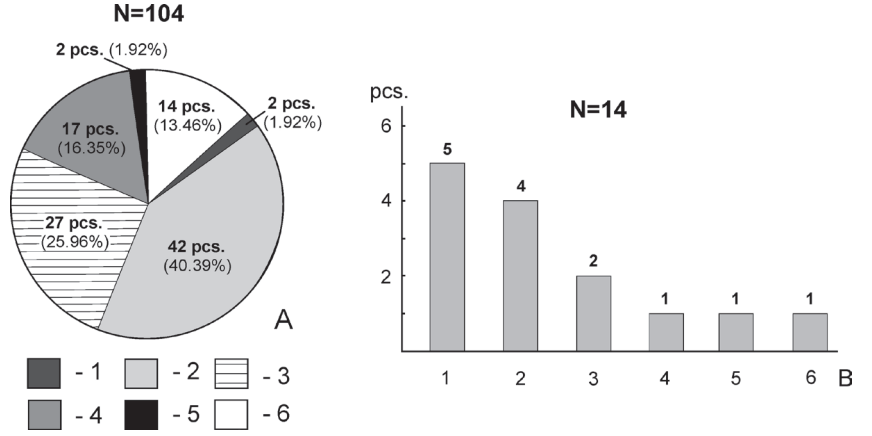

Fig. 4. Podlesie, site 6: obsidian inventory structure A – morphological differentiation of the collection (1 – cores; 2 – blades and their fragments; 3 – flakes; 4 – chips; 5 – sherds; 6 – retouched tools); B – typological differentiation of the tools (1 – retouched blades; 2 – endscrapers; 3 – blades with lateral retouch; 4 – truncated blade; 5 – scraper; 6 – perforator). Prepared by M. Przeździecki.

Table 1. Podlesie, site 6. Juxtaposition and calibration of obtained 14C dates. Prepared by M. Szeliga.

Symbol of sample	Laboratory, number of sample	14C data [BP]	Kind of sample	Calibration – after Ramsey 2013		Comments
				68.2% probability	95.4 % probability	
PDL6_A	Poz–102101	4710 ± 50	Wood tar	3627–3589 BC (17.1%) 3528–3498 BC (14.7%) 3454–3377 BC (36.4%)	3634–3552 BC (29.3%) 3541–3484 BC (21.7%) 3475–3370 BC (44.4%)	* small, 0.12 mg C
PDL6_B	Poz–101824	6130 ± 40	Wood tar	5206–5162 BC (20.6%) 5136–5130 BC (2.1%) 5120–5107 BC (4.3%) 5080–4997 BC (41.3%)	5211–4962 BC (95.4%)	

colour. This differentiation may indicate the origin of the raw material from various Slovak-Hungarian outcrops (Williams-Thorpe *et al.* 1984: 183).

In terms of techno-typology, three basic categories of products can be singled out in the presented inventory, containing:

a/ debitage products, including cores, blades, flakes and chips (88 specimens in total – 84.62%),

b/ debitage modification products, represented by retouched tools (14 examples – 13.46%; see: Fig. 4A),

c/ unspecified destructed sherds, including two (1.92%) non-characteristic, polyhedral fragments with a difficult to determine technological origin.

Within the first of the distinguished categories, cores are represented only by two small and heavily exploited artefacts: a flat bipolar splintered piece with cortical background (dimensions: 23 [height] x 14 [width] x 6 [thickness] mm; Fig. 5: 2) and a slightly larger (31 x 23 x 25 mm), regular single-platform blade core (Fig. 5: 1). Its flaking surface (located on the wider side of the concretion) is characterized by a small horizontal convexity and a clear incline at the base. The well-planned layout,

morphological coherence and above all – the lack of hinge points and blades tendency to incurve in distal part (so-called *overshot forms*), indicate a high level of the knapper's skills (no errors, control of the knapped blanks parameters). The platform preparation method has a characteristic division into a passive and active zone (see Wąs 2005: 131, fig. 56). The first of them is formed by large, but gently wedged scars with a concentric arrangement, resulting from several percussions from the left side of the core. In turn, the range of the active platform zone is determined by short and very fine scars with hinged ends, overlapping in a small area within the edge part of the platform (Fig. 4: 1). Probably the unfavourable angular relations between the flaking surface and the platform were the main reason for refraining from further blank exploitation, and consequently abandoning the core. The attempt to correct the core angle, although technically possible, was probably unprofitable, entailing a radical shortening of an already very small core.

The largest group are blades and their fragments (42 artefacts – 40.38%, see: Fig. 4A). They are represented only by medio-lithic or sub-microlithic examples, usually without cortex, with uni-directional dorsal pattern (Fig. 5: 6–16). Whole blades and proximal fragments have multi-scar butts, prepared by means of several precise percussions on the flaking surface, while the values of the core angle oscillate around 90°–95°. Attention is also drawn to the relatively large (laterally spread), though slightly arched bulbs, often co-occurring with a characteristic flaw in the form of a small scar (Fig. 5: 7–8, 12). These features are closely related both to the method of exploitation (i.e. the implementation of the serial debitage concept), as well as the technique of applying the impact force, most likely by indirect percussion using a soft punch (e.g. Iznian *et al.* 1999: 32). Particular attention is paid to a set of 14 fragments of regular, most probably intentionally broken, blades. They are characterized by the presence of more or less visible areas of damage of the edges, sometimes accompanied by single, very fine scars, usually occurring flatly on one of the edge surfaces (Fig. 5: 6, 9–10, 12–13). The nature, degree of intensity and repeatability of recorded macro-traces suggest their utilitarian genesis, justifying their interpretation as functional tools, probably used for activities of a similar nature. Planned micro-wear analyses probably will enable the verification of this hypothesis.

A slightly less numerous group are flakes (27 artefacts) and chips (17 specimens), comprising a total of 42.31% of the analysed collection (Fig. 4A). They are mostly of non-characteristic form, revealing a high degree of morphological and metric variations. The vast majority of them are pieces completely devoid of the cortex surfaces or with small areas of cortex on the upper surface. This group includes both the products of blade or flake core preparation (Fig. 5: 3), as well as their repairs during the exploitation of the blanks, related in particular to the core's angle correction (Fig. 5: 4) and the remains of unsuccessful blade knapping (Fig. 5: 5).

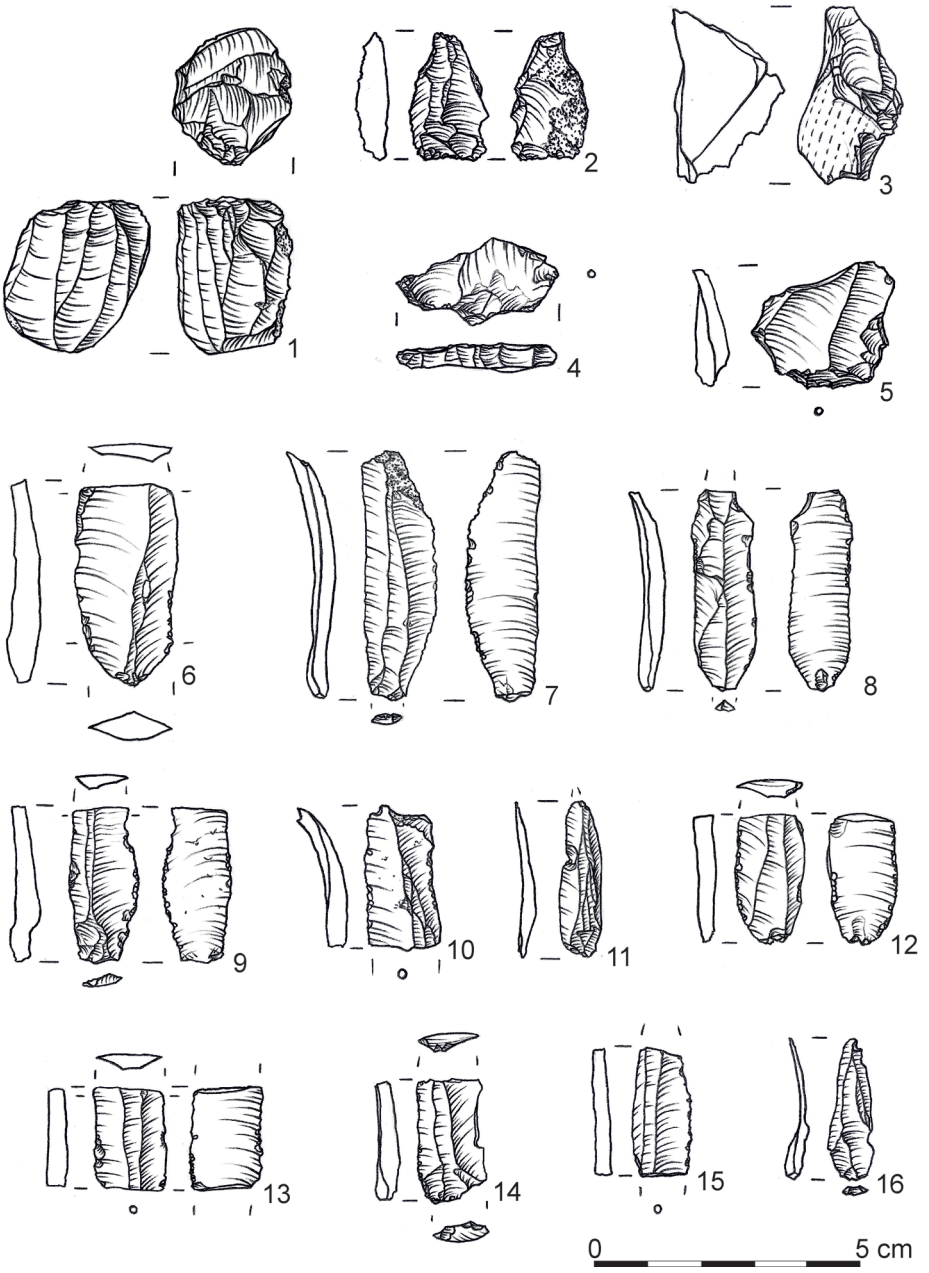

Fig. 5. Podlesie, site 6: selection of the obsidian finds obtained from non-feature layers (1–3, 5, 7–8, 10–12, 15–16), feature No. 2/2014 (4, 6, 9) and feature No. 1/2014 (13–14): 1– blade core; 2-bipolar splintered piece; 3–5 – flakes; 6–16 – blades. Drawing by A. Pałasz.

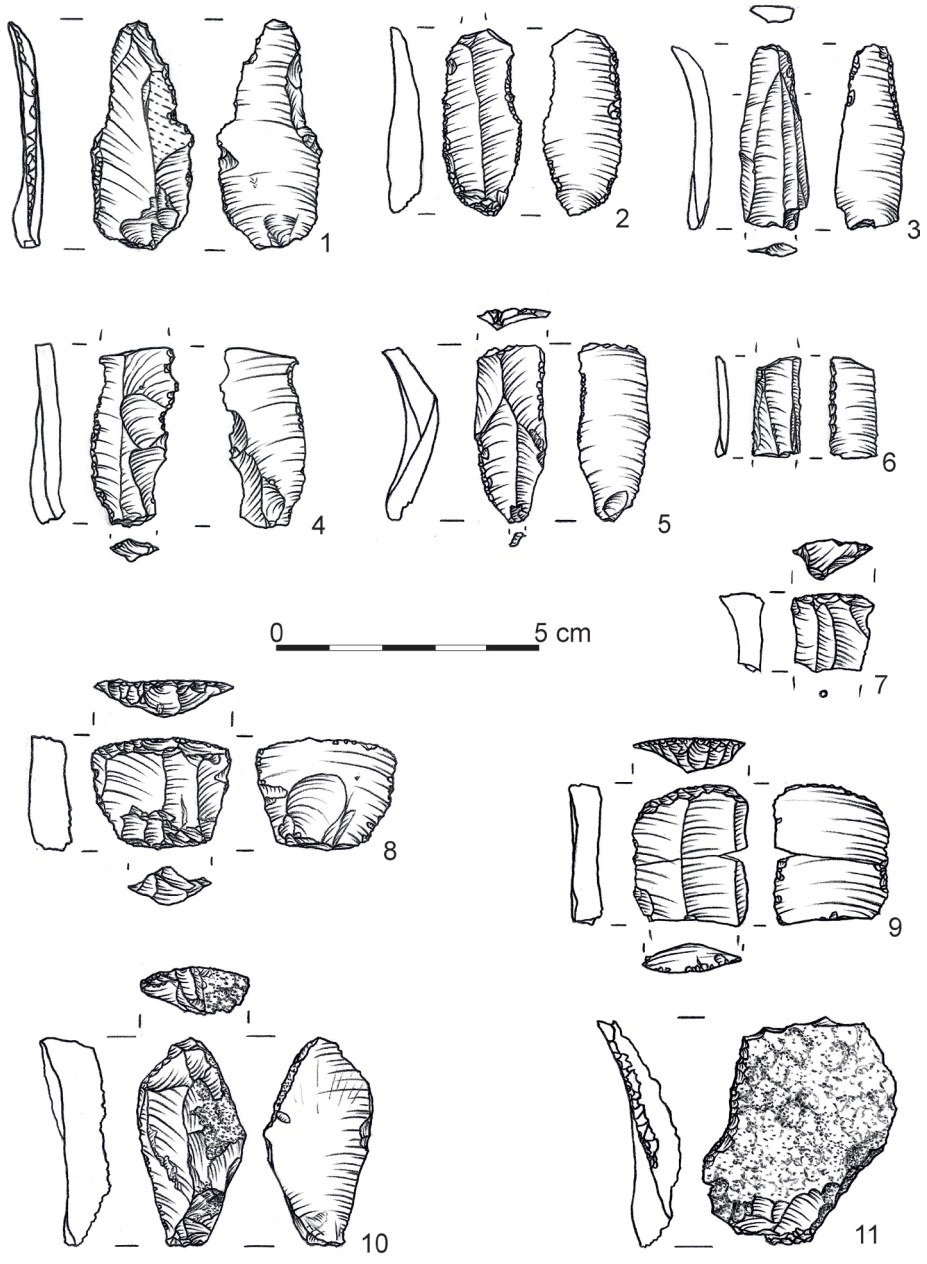

Fig. 6. Podlesie, site 6: selection of the obsidian finds obtained from non-feature layers (1, 3–4, 6–9, 11), feature No. 2/2014 (2, 10) and feature No. 1/2014 (5): 1 – perforator; 2–4, 6–retouched blades; 5 – truncated blade; 7–10 – endscrapers; 11 – scraper. Drawing by A. Pałasz.

Debitage modification products are represented by 14 morphological tools, representing about 13.46% of all obsidian finds (Fig. 4A). This collection, despite its small size, is characterized by a fairly large degree of typological diversity. The most numerous group are retouched blades (7 examples, Fig. 4B) made of blanks from the advanced phase of the exploitation of single platform cores, most often from non-cortical specimens (Fig. 6: 2–4). They do not reveal any regularity in the distribution, course or formation manner of the particular edges, including pieces with straight or convex edges, retouched on various section lengths (Fig. 6: 3–4, 6), as well as examples with various notches (Fig. 6: 2). A smaller group are endscrapers (4 artefacts, Fig. 4B), made on two regular scar blades (Figures 6: 7, 9), on a massive, partially cortical crested blade (Fig. 6: 10) and on a flake (Fig. 6: 8), originating from the blade-core flaking debitage surface reduction (resulting from unsuccessful blade percussion of the striking platform side, the so-called IIIB1 flake, see: B. Balcer 1975: 82). The other retouched tools are represented by single specimens: a regular truncated blade (Fig. 6: 5), a scraper on a massive, cortical flake (Fig. 6: 11) and a perforator with hardly formed point (Fig. 6: 1).

CONCLUSIONS

The results of the conducted analyses indicate the homogeneous nature of the obsidian collection from Podlesie, in terms of stylistics, technology and typology, at the same time revealing very important convergences with the flint material produced by the site (Przeździecki *et al.*, in print). That justifies the interpretation of the entire inventory as chronologically and culturally homogeneous in relation to the LBK settlement of the site at the end of the 6th millennium BC. The obtained results correspond also with the results of other analyses of obsidian inventories from the area of the Upper Vistula basin. Clear convergences are readable both in the general structures of inventories, as well as the frequency of particular categories of products, in each case including the dominance of debitage and generally very low or even minimal content of cores (Milisauskas 1983: tab. 1; Kaczanowska 1985: Abb. 23–24; Pelisiak 2014: tab. 14). On the other hand, a differentiating feature is the proportion of retouched tools in the analysed collection (14 specimens – 13.46%, see: Fig. 3A–B), comparable only with a very few other inventories, i. a. Cracow-Olszanica (Milisauskas 1986: tab. 93–94). The occurrence of this category of products at LBK sites is usually limited to a maximum of several artefacts (e.g. Kadrow 1990a: fig. 26: a; Pelisiak 2014: tab. 14–15; Wilczyński 2014: 500).

Similarities to other LBK obsidian inventories are also seen at the level of the general scope of this raw material processing and basic production trends, and to a lesser extent also the forms of its inflow. The low percentage of cortical pieces in the analysed collection suggests that obsidian reached the inhabitants of the Podlesie settlement in the form of prepared blade cores that were subjected to a complex processing on the

spot, oriented to the production of regular, though small, blanks. An analogous range of production activity is visible in the case of all the most-important inventories known from southern and south-eastern Poland (Szeliga 2009: 302–305). Possible differences can only be related to the form of obsidian inflow into local settlements, documented – in the case of the Cracow and Rzeszów clusters – in the form of natural concretions. It seems that these differences do not have any significant economic importance. In addition, the lack of nodules of this raw material in the Podlesie site may result only from the present small degree of its examination.

In the view of low degree of exploration of the Podlesie settlement, *a fortiori* the high percentage of obsidian should be emphasized, reaching the value of 4.79% (Fig. 3A). Although this proportion reflects its marginal economic significance in the local processing and tool production, it significantly exceeds the obsidian percentage in almost all LBK inventories known from the areas between the Sandomierz Upland, Proszowice Plateau and Miechów Upland (e.g. Godłowska 1976: 91–92; Kulczycka-Leciejewiczowa 1979: Fig. 26; Kaczanowska 1985: Abb. 22; Michalak-Ścibior and Taras 1995: tab. V; Szeliga 2008: Fig. 12). Currently, the only known inventory of higher obsidian percentage in the collective raw material structure originates from site No. 41 in Cracow-Nowa Huta-Krzesławice (about 10.7%), but it is entirely related to the younger, Želiezovce phase of this culture development (Godłowska 1982: 153). Therefore, the presented collection from Podlesie is the second LBK inventory (connected probably mainly with the music-note phase of its development), located outside the Rzeszów settlement cluster, in which the percentage of the obsidian exceeded the level of 4% (Szeliga 2009: Fig. 3). The discussed site is also the only excavated LBK settlement within the Połaniec Basin, and the acquired material culture assemblage is the only evidence confirming the influx of obsidian at the end of the 6th millennium BC. Whether the percentage of obsidian in Podlesie reflects the actual scale of its import and high economic importance for the local LBK communities, or is "only" the effect of applying high methodological standards during fieldwork, is currently an open question, which undoubtedly requires verification in the course of further research. Irrespective of this, the acquisition of the first and also so numerous obsidian inventory from the Połaniec Basin, along with the radiocarbon dates referring to this material, significantly supplements the current knowledge of the initial phase of obsidian inflow into the Upper Vistula basin in the Neolithic, dated at least at the end of the 6th millennium BC.

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Environmental Conditions of Settlement of the Danubian Communities in the Northern Foreland of the Sandomierz Upland

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The article raises the issue of the nature, intensity and environmental conditions of the settlement processes occurring on the borderline of the loessic Sandomierz Upland and the sandy-clay areas of the Iłża Foothills, between the end of the 6th and the beginning of the 4th millennia BC. The results of previously conducted research confirm the high settlement activity in these areas, throughout the period of development of the Danubian cultural groups. The obtained data document the phenomenon of the formation and functioning of the early-agricultural settlement centres in upland areas, located outside the range of compact loess cover, i.e. within ecological and landscape zones that diverge from the basic preferences of the Danubian communities, inhabiting the upland areas of the upper Vistula basin.

KEY-WORDS: Neolithic, Danubian communities, settlement, marginal zone of loess cover, natural environment.

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INTRODUCTION

The Sandomierz Upland is one of the most cognitively important regions for studies on the sequence, nature and dynamics of cultural changes, taking place in the Neolithic area within the broadly defined northern foreland of the Carpathians and neighbouring areas. Its geomorphological, hydrological and – especially – soil characteristics, resulting from the presence of a fertile soil cover, formed on a loess ground, as well as close proximity to the abundant deposits of various siliceous rocks, located within the Mesozoic north-eastern slopes of the Świętokrzyskie Mountains, were among the most important factors determining the very high intensity of settlement of agricultural communities between the 6th and 3rd millennia BC. This also applies to the early phase of this period, related to the development of the Danubian communities, in terms of taxonomy identified with the Linear Pottery culture (LBK), the Malice culture (MLC), the Samborzec-Opatów group (S-OG) and the Lublin-Volhynian culture (L-VC). Although the results of previous research indicate a fundamental relationship between the settlement of these communities and the Sandomierz Upland loess cover, the latest data confirm their significant settlement activity also in the area of its northern edge, especially in a different ecological and landscape zone, covering its northern foreland. Currently, from a very small section of this borderland, extending from Ćmielów (Ostrowiec Świętokrzyski district) to Ożarów (Opatów district), as many as 49 sites, related to the Danubian chronological and cultural horizon, are known (Fig. 1C). They significantly supplement the current level of knowledge of the settlement preferences, and – at the same time – the capabilities for adaptation of the early-agricultural communities in the broadly defined "Sandomierz settlement region".

STATE OF RESEARCH

In the light of the current state of research, the main area of the settlement activity of the Danubian communities covered mainly the central and eastern part of the Sandomierz Upland (Czekaj-Zastawny 2008; Kowalewska-Marszałek 2012: Fig. 4–5). This is confirmed by the results of previous excavations (e.g. Podkowińska 1959; Więckowska 1971; Michalak-Ścibior and Taras 1995; Kulczycka-Leciejewiczowa 2008; Kowalewska-Marszałek 2017), as well as numerous diagnostic surface finds (Michalak-Ścibior 1992: Fig. 2; Kowalewska-Marszałek 2002: 179–185; 2008: 248–253). Until recently, distinct differences in this regard were found in the areas located within this mesoregion's northern edge, especially its foreland – part of the Iłża Foothills (Kondracki 2002: Fig. 38; Fig. 1A–B). Relics of the settlement of Danubian communities in these areas were represented only by a few less characteristic findings, found mainly in the loess plateau edge zone (Podkowińska 1952: table XVIII: 4). From the

neighbouring sandy-clay areas of the Iłża Foothills, only a few single sites were known, indicating the occasional exploitation of local flint outcrops (see e.g. Balcer and Kowalski 1978: 132; Libera and Zakościelna 1990: 62; Budziszewski 1991: 60), rather than permanent settlement on these areas. This situation indicated the clearly different nature of the activities of the Danubian communities in both areas, and showed the link between their stable settlement and the loess cover of the Sandomierz Upland. This corresponded well to the previous arrangements, regarding the settlement preferences of the Danubian cultural circle (e.g. Modderman 1959: 3–6; Sielmann 1971: 80–124; Končelová 2012), including the clusters occupying the upper Vistula basin (Kruk 1973: 72–74; Kruk *et al.* 1996: 41–48; Czekaj-Zastawny 2008: 98–104).

New, important data were provided by the results of excavations on site 2 in Ćmielów, Ostrowiec Świętokrzyski district (Michalak-Ścibior 1994), as well as on sites 6 and 12 in Tominy, Opatów district (Szeliga and Zakościelna 2007; Szeliga 2008; Kadrow and Olejarczyk 2010), located outside the edge of the loess plateau, in the southern part of the Iłża Foothills (Fig. 1C and 2A–B). They confirmed the functioning of the early-agricultural single settlements within this unusual, non-loess ecological and landscape zone, starting from the oldest Neolithic phase. They have also become the main reason for undertaking the essential interdisciplinary research, focused, on the one hand, on identification of the basis, nature and intensity of the Danubian settlement, as well as the range of their economic activity in the areas discussed here, and on the other hand – on the reconstruction of all environmental conditions and consequences of these processes, in their chronological and cultural contexts.

OBJECTIVES AND METHODS

The main goal of the presented study is an attempt to preliminarily assess the nature and scale of the settlements of the Danubian cultural circle, as well as the general characteristics of their relationship to the environmental conditions within the edge part of the Sandomierz Upland and the non-loess zone of its northern foreland. The basic reference plane for these considerations are the results of archaeological research conducted in this area between 2014 and 2018, supplemented by geological, geomorphological and pedological data, as well as archaeobotanical and archeozoological observations. These data, despite being still incomplete, provide the basis for a preliminary, general assessment of the local natural environment potential and the scope of its use by the early agricultural communities. Archaeological research included both systematic surface surveys, as well as excavations on some of the most promising sites. During the surface surveys, the greatest attention was focused on the areas located in the immediate vicinity of the loess plateau, especially along the valleys of the Wyszmontów Stream, Przepaść and Krzczonowianka rivers. Surveys on more

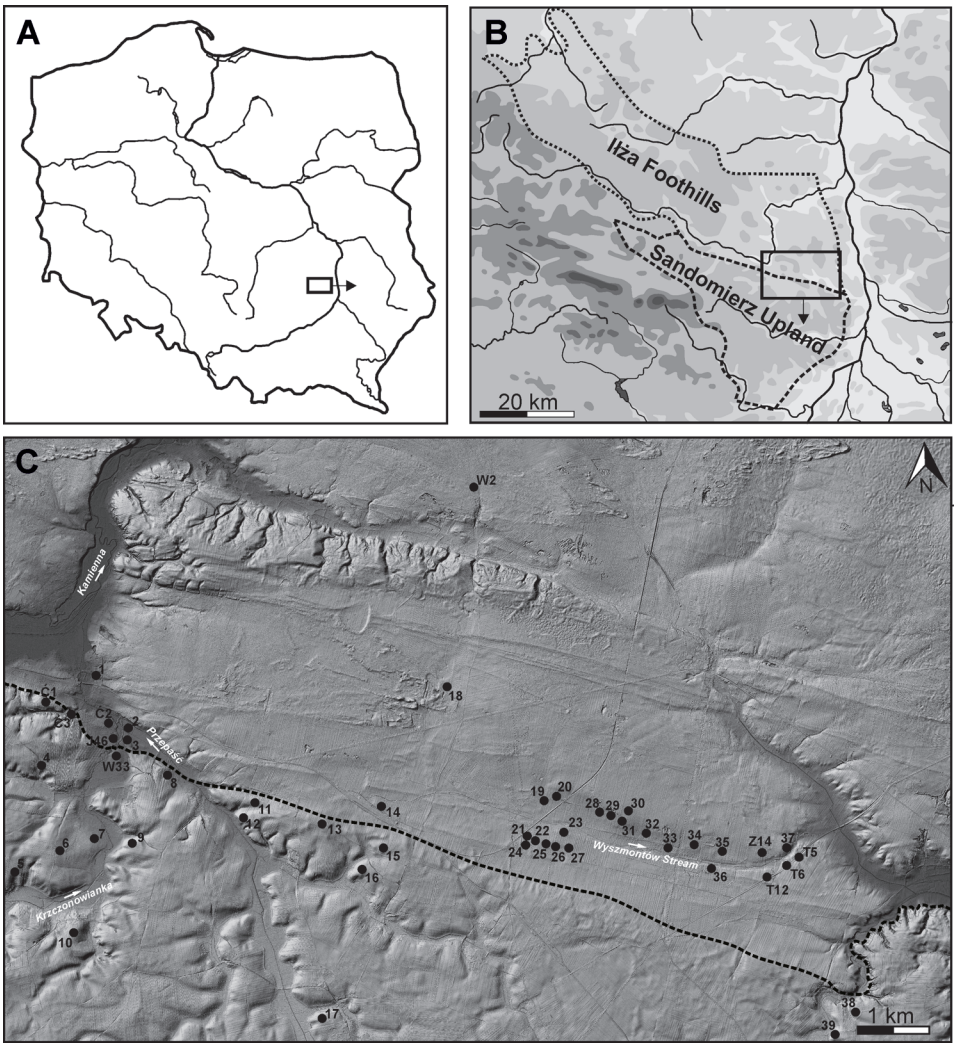

Fig. 1. Research area (A–B) with general location of sites related to Danubian cultural circle (C), discovered during surface surveys (numbers) and excavations (letters) within the northern part of Sandomierz Upland and its northern foreland: (B – on the basis of Kondracki 2002, C – range of loess cover by Mroczek 2007, Fig. 1). Archaeological sites; excavated: Ć1, 2, 3 – Ćmielów, site. 1,2, 95, Ostrowiec Świętokrzyski district; J46 – Jastków, site 46, Ostrowiec Świętokrzyski district; T5, 6, 12 – Tominy, site 5, 6 i 12, Opatów district; W2 – Wojciechówka, site 2, Opatów district; W33 – Wólka Wojnowska, site 33, Ostrowiec Świętokrzyski district; Z14 – Zawada, site 14, Opatów district; Surface surveyed: 1 – Ćmielów, site. 64 (AZP 85–71/190); 2 – Wólka Wojnowska, site 8 (AZP 85–71/123); 3 – Wólka Wojnowska, site 5 (AZP 85–71/120); 4 – Jastków, site 31 (AZP 85–71/272); 5 – Glinka, site 4 (AZP 85–71/173); 6 – Jastków, site 41 (AZP 85–71/370); 7– Jastków, site 38 (AZP 85–71/367); 8 – Wólka

Wojnowska, site 18 (AZP 85–72/153); 9 – Wólka Wojnowska, site 26 (AZP 85–71/241); 10 – Buszkowice, site 18 (AZP 86–71/136); 11 – Drygulec, site 15 (AZP 85–72/110); 12 – Drygulec, site 14 (AZP 85–72/109); 13 – Drygulec, site 18 (AZP 85–72/180); 14 – Ługi, site 3 (AZP 85–72/179); 15 – Mikułowice, site 41 (AZP 85–72/181); 16 – Mikułowice, site 10 (AZP 85–72/16); 17 – Wojciechowice, site 11 (AZP 86–72/54); 18 – Julianów, site 17 (AZP 85–72/182); 19 – Wyszmontów, site 32 (AZP 85–72/54); 20 – Wyszmontów, site 33 (AZP 85–72/55); 21 – Jasice, site 46 (AZP 85–72/185); 22 – Wyszmontów, site 64 (AZP 85–72/184); 23 – Wyszmontów, site 65 (AZP 85–72/187); 24 – Jasice, site 47 (AZP 85–72/186); 25 – Wyszmontów, site 30 (AZP 85–72/51); 26 – Wyszmontów, site 29 (AZP 85–72/50); 27 – Wyszmontów, site 63 (AZP 85–72/183); 28 – Wyszmontów, site 35 (AZP 85–72/57); 29 – Wyszmontów, site 36 (AZP 85–72/58); 30 – Wyszmontów, site 66 (AZP 85–72/188); 31 – Wyszmontów, site 37 (AZP 85–72/59); 32 – Wyszmontów, site 4 (AZP 85–73/166); 33 – Wyszmontów, site 5 (AZP 85–73/167); 34 – Wyszmontów, site 3 (AZP 85–73/165); 35 – Wyszmontów, site 60 (AZP 85–73/281); 36 – Wyszmontów, site 61 (AZP 85–73/282); 37 – Zawada, site 42 (AZP 85–73/214); 38 – Jankowice, site 11 (AZP 86–73/146); 39 – Bińkowice, site 2 (AZP 86–73/138).

distant areas was only of a verification nature, covering exclusively sites (and their immediate surroundings) related to the Danubian horizon during prior surface surveys of the Polish Archaeological Record Project (Fig. 1C).

RESULTS

Archaeological data

As a result of the conducted surface surveys, 12 new Danubian circle archaeological sites were discovered, and 37 previously known ones were verified. The vast majority of them are grouped within two basic zones. The western zone includes areas located directly at the junction of the loess cover and sandy-clay deposits, ranging from Ćmielów in the west to Mikułowice and Ługi (Opatów district) in the east (Fig. 2A). They are generally characterized by a significant degree of the dispersion of the settlement remains, with a significant concentration of large settlement sites in a small area along the lower section of Krzczonowianka, near its mouth to the Przepaść River. The eastern zone is located entirely in the non-loess area, at a distance of about 0,5 to 1 km from the edge of the Sandomierz Upland, extending from Wyszmontów, Opatów district in the west, to Tominy in the east (Fig. 2B). It includes a greater number of settlement remains, represented both by a large sites, as well as numerous trace findings. In comparison to the western zone, they reveal a much larger degree of territorial density, extending along the middle section of the Wyszmontów Stream valley, primarily in the upland range on its northern side, but also within its lower part. Except the mentioned areas of concentration, only two sites related to the Danubian horizon are currently known in the discussed area, represented by an undefined settlement site in Julianów, Opatów district and presumably a seasonal camp related to the exploitation of nearby Chocolate flint outcrops in Wojciechówka, Opatów district (Fig. 1C).

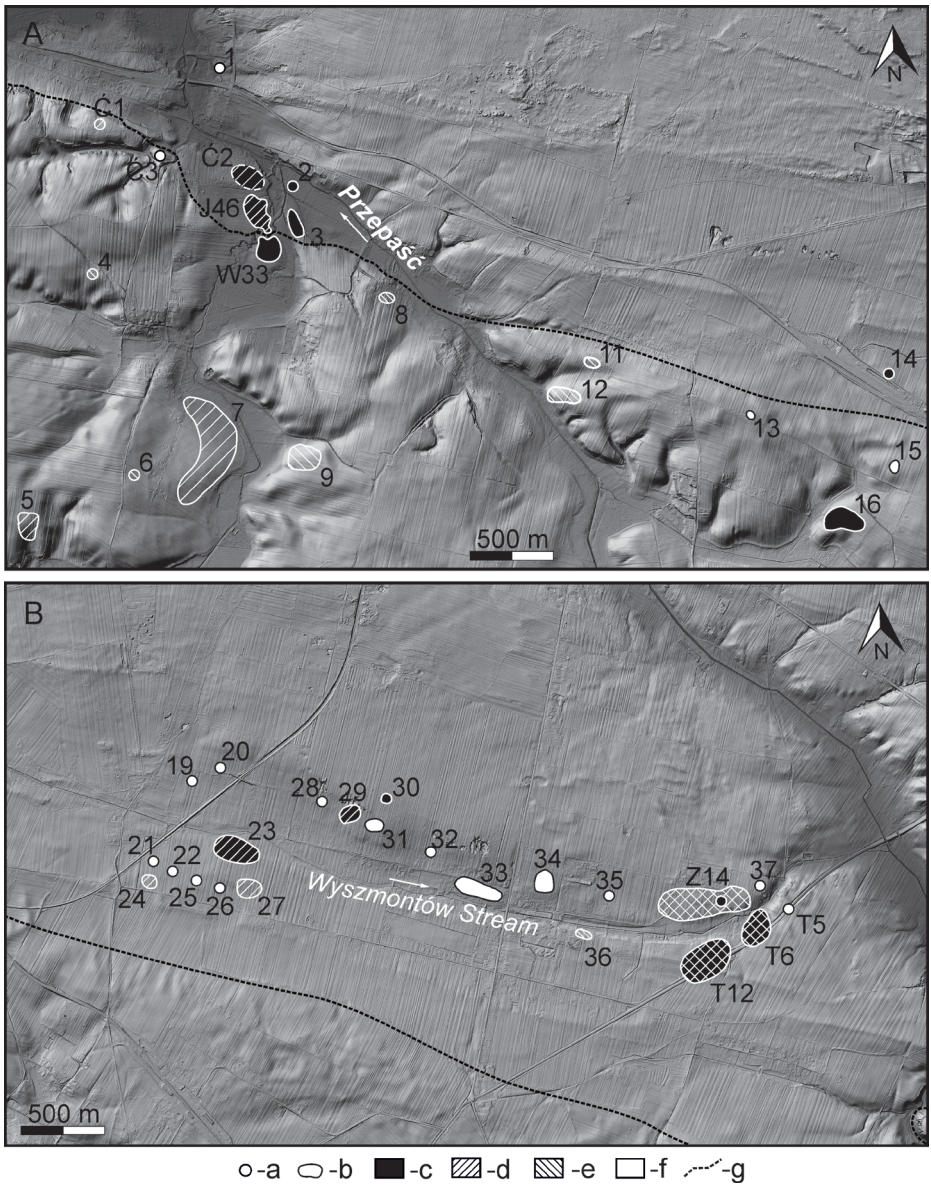

Fig. 2. Location and cultural classification of sites within the western (A) and eastern (B) microregions of settlement of the Danubian communities: a – stray finds; b – settlements; c – Linear Pottery culture; d – Malice culture; e – Lublin-Volhynian culture; f – unidentified Danubian circle groups; g – range of Sandomierz Upland loess cover (by Mroczek 2007: Fig. 1).
Designations of sites (numbers and letters); cf. Fig. 1C.

The artefacts obtained in this work enabled the establishment of the chronological and cultural classification of only some of the discovered and verified sites. A total of seven sites were related to the LBK, from which a very few diagnostic ceramic fragments and flint products were collected. They do not reveal any apparent regularities in distribution, occurring in a loose scatter within both separated regions of concentration (Fig. 1C).

A more numerous group are sites related to the post-linear horizon, represented by five MLC sites located only within the eastern zone, as well as five L-VC sites, scattered along the whole edge of the Sandomierz Upland (Fig. 1C). It is most likely complemented by the majority of the other sites, generally classified as Danubian. Despite the fact that they cannot be precisely related to any culture, the raw materials and morphometric properties of the obtained flint materials, justify their general linkage to the post-linear horizon of the Danubian settlement.

The results of surface surveys are complement by the results of excavation research. In the eastern zone, they included work on the LBK site 6 in Tominy, systematically continued since 2006, as well as a preliminary investigation of the site 14 in Zawada, Opatów district, located on the opposite bank of the Wyszmontów Stream (Fig. 1C) and – on the basis of surface findings – related to MLC (Szeliga *et al.* 2018: 161, Fig. 2D–E). The acquired data (remnants of archaeological features and rich artefacts) confirmed the existence of permanent and extensive settlements on both sites, related to the late-note and early-Želiezovce LBK phases (Tominy) and the late-classical MLC phase (Zawada). The first radiocarbon dates from Tominy provide a dating of the LBK settlement at least between 5100 and 4800/4700 BC (Szeliga 2017: 441). In addition, there was only a small amount of L-VC diagnostic materials on both sites. However, they did not have any firm context in archaeological features, which makes it impossible to assess the nature and scale of the settlement activity of this culture. Similar results were obtained for the western zone, where archaeological excavations started in 2018 were devoted to the preliminary investigation of site 46 in Jastków and site 33 in Wólka Wojnowska, Ostrowiec Świętokrzyski district, where the existence of the LBK settlement of the Želiezovce phase had already been confirmed (Matyaszewski 2017). Previously collected materials clearly indicate the extensive and permanent nature of both settlements, as well as their occupation on the classical and late phase of the LBK and the classical phase of MLC (Jastków).

Geological and geomorphological setting

The research area is located on the border of two physical and geographical mesoregions within the northern, marginal part of the Małopolska Upland (Fig. 1B). It also lies at the point of contact of two different morphogenetic belts of continental range, loessic and sands (Koster 1988: 69–83). The lithology of the surface sediments exhibit a distinct duality in the latitudinal system. The southern part is called the Sandomierz loess patch, entirely covered by aeolian loess, mainly of Vistulian (=Weichselian) age,

with a thickness of up to 20 m (Mroczek 2007: Fig. 2). The main feature of the loess cover is its uniform, continuous and compact character, interrupted only by river valleys, within which there are no such deposits (Łanczont *et al.* 2014: 30–35). In turn, the surface sediments of the northern part (Iłża Foothills) are characterized by a much more varied, mosaic structure, including Pleistocene sediments of various lithological nature. Also present, though restricted to the bottoms of river valleys, are Holocene alluvial deposits (Fig. 3). The surface exposures of older sediments are mainly glacial tills of the Saalian age, enriched locally with rocky rubble. They build marginal forms within moraine plains, forming strings of isolated, strongly denuded remnant hills. The topmost surface is covered by a relatively thin series of Late Vistulian silicate sands, forming continuous covers, and in some places typical parabolic dunes. They are accompanied by small loess patches with a thickness of a few metres, taking the form of isolated islands and gredas. Their morphological position and spatial orientation emphasize, on the one hand, the diversity of the older topography, and on the other, they indicate the dominant directions of the ancient loess accumulation winds (Fig. 3). The bedrock underlying the Quaternary sediments across the entire area are Jurassic and Upper Cretaceous carbonate rocks, which often appear as outcrops on the surface (Złonkiewicz 1998).

The lithological belt-like duality of this area is reflected in the spatial diversity of the differences in levels and slopes. Their much higher values are typical features of the loess area. This applies first of all to the contact zone of the loess patch with the valleys of Czyżówka River and Kamienna River, which have clearly sublatitudinal course (Fig. 1C and 4). Differences in level within the northern part of the Sandomierz loess patch reach up to 30 m and even 40 m. Generally, this loess patch, characterized by a negligible amount of flat, level surfaces (plateau), is heavily cut with a system of dry erosion-denudational valleys and slope depressions (Fig. 4). In the plateau zone, there are areas of isolated closed depressions (see Maruszczak, 1954: 123–137; 1961: 93–122). The northern, non-loess part of the studied area is characterized by much smaller relative heights, which only locally increase to 20 m (Fig. 4). The consequence of this is the relatively small inclination of the slopes, especially marked within the valley zone of two rivers – Wyszmontów Stream and the Przepaść River. The location of the discovered archaeological sites clearly indicates that the gentle slopes and culminations of the small hills that extend along these valleys were particularly preferred as settlement areas by the communities of the Danube groups (Fig. 1C and 4).

Soil cover

The specific lithological types of substrate rocks and the topographic character of the surface affect the different development of the soil cover within both border regions discussed here. The southern part of the research area is characterized by a generally low degree of variation in soil cover, limited to fertile brown soils and lessivè soils (often

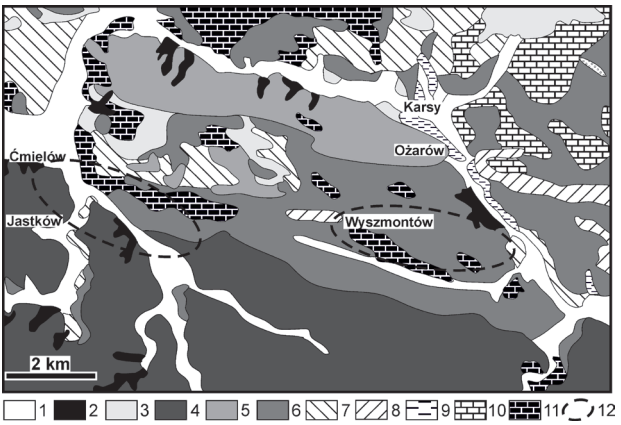

Fig. 3. Surface sediments in the marginal zone of the Sandomierz Upland between Ożarów and Ćmielów (on the basis of Mapa Geologiczna Polski 1:200.000 downloaded from https://geolog.pgi.gov.pl). Legend: Holocene: 1 – river sands and silts, 2 – colluvial sediments; Vistulian: 3 – cover sands, 4 – loess, 5 – sandy loess; Saalian: 6 – glacial tills, 7 – fluvioglacial sands and gravels, 8 – kame sands, 9 – lacustrine silty sands; Cretaceous: 10 – limestones and opokas (silaceous limestones); Jurassic: 11 – limestones; 12 – microregions of settlement of the Danubian communities.

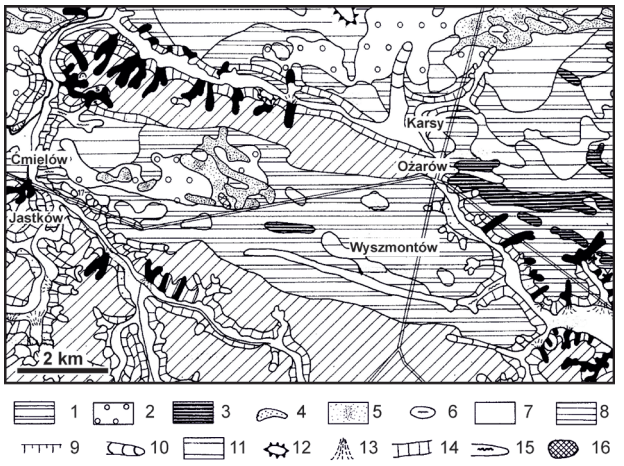

Fig. 4. Geomorphologic map of the marginal zone of the Sandomierz Upland between Ożarów and Ćmielów (after Złonkiewicz 1998 with modifications). Symbols: 1 – glacial plain, 2 – fluvioglacial plain, 3 – kemes, 4 – dunes, 5 – sand cover, 6 – deflation depressions, 7 – floor of river valley, 8 – accumulation terrace, 9 – terrace edge, 10 – channelled valley, 11 – fragments of Tertiary erosion surfaces, 12 – surfaces of the pedestal, 13 – alluvial fan, 14 – erosional-accumulation edge, 15 – karstic valley, 16 – anthropogenic embankment.

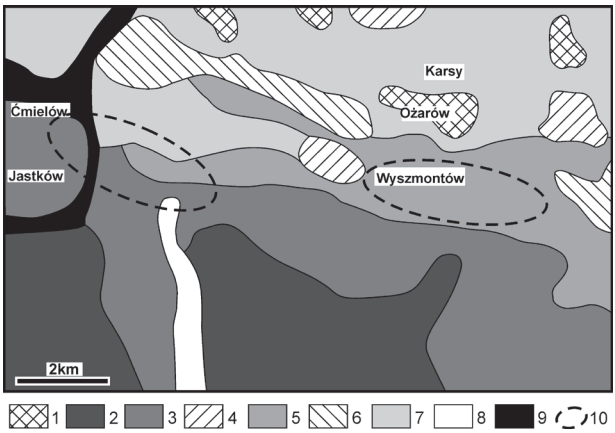

Fig. 5. Soil cover in the marginal zone of the Sandomierz Upland between Ożarów and Ćmielów (on the basis of Mapy gleb Polski 1961, simplified and modified). Symbols: 1 – rendzinas developed on Jurassic and Cretaceous carbonate rocks; 2 – chernozems developed on loess; 3 – complex of Cambisols and Luvisols developed on loess and loess-like deposits; 4 –Luvisols developed on glacial tills and weathered clays; 5 – Luvisols developed on aquatic silts; 6 – Luvisols developed on loess and loess-like deposits; 7 – rusty soils and podzolic soils in place underlain with carbonate rocks made of weak loamy sands and loamy sands; 8 – muddy soils, peat and ground and gleyic soils; 9 – Fluvial soils (silty, loamy and clay); 10 – microregions of settlement of the Danubian communities.

truncated Luvisols) derived from loess and loess-like sediments (Fig. 5). The northern part is characterized by a much more diversified, mosaic structure, covering the good loess soils derived from aquatic silts in the region of the edge of the loess plateau, which extends further north into low-fertility rusty and podzol soils derived from sandy sediments. The alluvial soils commonly documented in the bottoms of river valleys are relatively young soils (Fig. 5). The location of the discovered remains of settlement strongly correlates with this differentiation, showing their clear concentration in the area of good (western microregion) and medium good soils (eastern microregion) in terms of agricultural usefulness (Fig. 5). The distribution of individual sites in a zone dominated by rusty and podzol soils poor in nutrients for plants (Wojciechówka 2) indirectly indicates their non-agricultural character. This corresponds to the seasonal activity of human groups postulated for them, including with the exploitation of flint deposits there.

Potential natural vegetation

Geological and geomorphological factors as well as soil types would directly affect habitat types of potential natural vegetation (Matuszkiewicz 2007). For the studied area, the potential natural vegetation consists mainly of two basic forest communities;

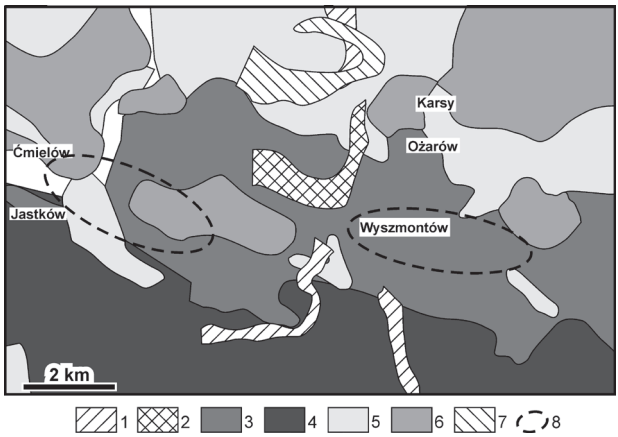

Fig. 6. Natural plant cover in the marginal zone of the Sandomierz Upland near Ożarów and Ćmielów (on the basis of Matuszkiewicz 2007). Legend: 1 – Ficario-Ulmetum chrysospl., 2 – Fraxino-Alnetum (Circaeo-Alnetum), 3 – Tilio-Carpinetum (Litt. Pol., poor), 4 – Tilio-Carpinetum (Litt.-Pol., rich), 5 – Potentillo albae-Quercetum typicum, 6 – Querco-Pinetum, 7 – Festucetalia valesiacae; 8 – microregions of settlement of the Danubian communities.

the southern part would have been dominated by the oak-hornbeam forest (*Tilio-Carpinetum association*) and the northern one would have supported a dry-ground oak dominated forest habitat (*Potentillo albae-Quercetum typicum association*). The area of the Sandomierz loess patch would have been occupied by an oak-hornbeam (*Tilio-Carpinetum* typicum) vegetation type, which is a broad-leaved deciduous forest growing in fresh habitat. The forest was relatively wet with the dominance of pedunculate oak *Quercus robur* and common hornbeam *Carpinus betulus*, with a small amount of European beech *Fagus sylvatica*, small-leaved lime *Tilia cordata*, common spruce *Picea abies* and silver fir *Abies alba* (Fig. 6). In turn, for the northern sandy part, typical habitats would have been oak-dominated communities (*Potentillo albae-Quercetum* typicum), constituting forests in the habitat type of a mixed forest with the dominance of sessile oak *Quercus petrea* and a constant natural admixture of Scots pine *Pinus sylvestris* in the forest composition. In addition, in the northern part the mixed forests of *Querco roboris-Pinetum* would have potentially been found, and thus the natural forest communities would have had a dominance of common oak and pine. Azonal plant habitats are associated with river valleys (Kamienna and Przepaść rivers and Wyszmontów Stream). These are assigned to the communities of moist forests associated with fertile and hydrated habitats, i.e. *Ficario-Ulmetum* and *Fraxino-Alnetum* types. The first mentioned is an ash and elm riparian forest, and the second one an ash and alder forest (Fig. 6). In both types of communities, pedunculate oak would

have been present in the admixture. With reference to the discovered remains of the settlements of early farming communities (Fig. 1C), their occurrence can be assumed to have lain in places potentially occupied by forest communities with a significant share of oak, mainly growing in mixed oak and pine woodland in habitats outside river valleys and at the intersection of these communities with riparian forests and it can be assumed that they mainly exploited such areas.

Archaeobotanical data

Archaeobotanical studies on the samples obtained during the excavations in Tominy 6 included the analysis of macroscopic plant remains extracted during wet sieving of collected soil samples, imprints preserved in fired daub and ceramics, as well as charred wood. In the soil samples, mainly fruits and seeds have been preserved, some of which were uncharred. Remains of the last type were not included in the interpretation, because – according to assumptions adopted in archeobotany – such specimens, found in the dry deposit, are not related to the archaeological context (Lityńska-Zając and Wasylikowa 2005: 50–51).

In the examined material, mainly the remains of primordial hulled wheat have preserved: emmer *Triticum dioccon* and einkorn *T. monococcum*. These were the caryopses and parts of the schaff, such as spikelets, basal parts of spikelets, so called "spikelet fork" and glumes, relatively abundant in the clay, both in the form of imprints, as well as burnt and highly dried fragments of tissues embedded in the clay. On this basis, it can be assumed that the crops of the LBK population were dominated by emmer and einkorn wheats. The local nature of the crops is confirmed by single diaspores of field weeds (e.g. rye brome *Bromus secalinus*), preserved in the studied material. Quantitative analyses indicate the more frequent occurrence of *Triticum dioccon* residues, which suggests the greater economic importance of this species. Previous archaeobotanical data confirm that both types of hulled wheat were an important cereal for the LBK communities in various regions of present-day Poland (i. a. Gluza 1994; Bieniek 2007; Lityńska-Zając 2007; Lityńska-Zając *et al.* 2014; Lityńska-Zając *et al.* 2017). They could be sown separately or in the form of a mixture, in which the emmer wheat probably played the dominant role. Their joint growth in one field was possible because they are characterized by similar biological properties, such as sowing time, the date of emergence and harvest, and the length of the growing season, as well as the edaphic requirements. In Russia, such mixtures were sown even in the 20th century (Janušević 1976: 44). It can not be ruled out that the einkorn may have appeared as a weed in a field of emmer. It is a persistent weed because – due to the greater brittleness of the ear – it can sprinkle spikelets before harvest from the field and thus caryopses itself (Gluza 1994).

Possibly, the grains of wheat were ground into flour or pounded for groats. It is a well-absorbed food, because it contains a lot of carbohydrates, mainly in the form of

starch, as well as much smaller amounts of protein and fat (Domańska *et al.* 1982: 255). The einkorn flour has special properties: it has high nutritional values and, in comparison with other wheat species, it contains more protein and gluten. It is characterized by intense yellow colour, due to the high content of β-carotene (Mielke and Rodemann 2007). It is very likely, that the straw was also used, for instance to cover roofs, or as a bedding for farm animals (Lityńska-Zając and Wasylikowa 2005: 69, 77). The presence of cereal remains and cereal straw fragments in the daub and ceramics clearly confirms the intentional addition of threshing residue to the clay, which was also observed at other sites from the early Neolithic period (e.g. Moskal-del Hoyo *et al.* 2017, further literature there).

Archaeozoological data

A total number of 767 poorly preserved bone remains from site Tominy 6 were analysed (Makowiecki 2018). The species and anatomical affiliation was specified only for 22.2% of specimens. They belong mainly to domestic (about 46%) and wild (52%) mammals. The last group also includes a horse. The remaining, inconsiderable percentage comprises fish remains (pike), reptiles (European pond turtle) and birds (1 unidentified specimen). Among the wild mammals, apart from the horse, almost the same number of deer remains were recorded. Only a few remains belong to the deer, moose, fox, bear and badger. There were also some remains of aurochs or a very large cattle variety, as well as wolf or a very large dog. Among the domestic mammals the most numerous are cattle and small ruminants, i.e. sheep/goat, with much smaller percentage of pigs.

The diverse structure of the fauna from Tominy results from the combined method of obtaining raw materials of animal origin. This consisted, on the one hand, of the breeding of domestic mammals as part of the culturally-determined form of agriculture, and on the other, the important role of hunting, mainly for horses. According to the current state of knowledge (Benecke 2006), it should be assumed that the remains of hunted animals originated from free-living (wild) populations. The range of fauna, due to habitat preferences belonging to different groups (Makowiecki 2008, there further literature), indicates the exploitation of diverse landscape zones by the settlers, both forest areas (deer, badger and bear), as well as open, grassy habitats (horse). The latter habitats were also suitable for grazing domesticated herbivorous ruminants. The presence of moose indicates the hunting penetration of forest, wetland and swampy areas, possibly located in the valley of Vistula or smaller, closer streams, i.e. Czyżówka River or Wyszmontów Stream. Presumably, in small watercourses of this type, as well as in eutrophicated river pools, pikes and mud turtles were caught. The latter species was one of the most important components of the diet among the peoples of Atlantic optimum cultures (Makowiecki and Rybczyński 2001). Fishing and turtle hunting were particularly important in spring and in early summer, when the stocks

of agricultural products were depleted, and animals of these species gather into herds for reproductive reasons (Makowiecki 2003).

DISCUSSION AND CONCLUSIONS

The results of the conducted research confirm an intense and permanent nature of the settlement at the intersection of the Sandomierz Upland and Iłża Foothills, throughout the period of development of groups cultivating the Danubian cultural traditions. From this small borderland, currently 49 sites are known (Fig. 1C) that document the settlement activity of culturally diverse early-agricultural communities, at least from the late 6th to the beginning of the 4th millennia BC. They mark the northernmost range of the dense Danubian groups settlement, broadly understood as the "Sandomierz ecumene of settlement", at the same time clustering within at least two basic settlement microregions, located at the intersection of loess patch and sandy--clay formations (Ćmielów-Wólka Wojnowska) and entirely beyond the loess cover (Tominy-Wyszmontów). Their location seems to indicate a much higher settlement intensity at the borderline of both mesoregions, than in the entire northern part of the Sandomierz Upland (Fig. 1C and 2A–B). However, it should be emphasized that this picture may be accidental and result only from the different intensity of archaeological research, carried out so far in both these areas.

Despite its preliminary nature, the obtained information enables a general reconstruction of the colonization on the edge of the Sandomierz Upland and its northern foreland, and to attempt a provisional assessment of the intensity of these processes over the 6th and 5th millennia BC. The initial phase was marked by the emergence (at least in the last quarter of the 6th millennium BC) of the LBK community, which established several settlements along the Wyszmontów Stream (Tominy 6 and 12) and the lower courses of Krzczonowianka and Przepaść rivers (Ćmielów 2, Jastków 46, Wólka Wojnowska 33). These were large and permanent settlements that functioned even for about 200–300 years, as indicated by the radiocarbon dates from site 6 in Tominy (Szeliga 2017). They initiated the development of the local settlement network, continued almost unchanged by post-linear communities throughout the 5th millennium BC. This is indicated, among other things, by the widespread presence of remains of MLC settlements, recorded within the earlier LBK settlement sites (Michalak--Ścibior 1994; Szeliga and Zakościelna 2007: 14; Kadrow and Olejarczyk 2010: 136). The range of the stylistic diversity on the MLC ceramics (Ib and Ic phases) discovered on these sites allows indirect assumption of a longer settlement period than in the case of LBK of both microregions by communities of this culture, within the range of 4800–4200 BC (see Kadrow and Zakościelna 2000: Fig. 45). The youngest period of the Danubian settlement in these areas was connected with the appearance of the

L-VC population, presumably in the first half of the 4th millenium BC. Currently it is the least-known episode of Danubian settlement, documented by diagnostic artefacts discovered mainly outside features, and only sporadically (Tominy 6 and 12) by a few immobile features (Szeliga and Zakościelna 2007: 14; Kadrow and Olejarczyk 2010: 136). Although this situation indicates the continuation of settlement processes in the discussed areas during the L-VC development period, this hampers the unambiguous assessment of its actual intensity and length of continuance within both microregions. The nature of previous findings and the distribution of L-VC sites (Fig. 2A–B) may indicate a diminution of settlement in relation to earlier periods and shifting its main concentration to the loess hills of the northern Sandomierz Upland.

Regardless of the chronological and cultural affiliation of particular findings and sites, the location of both regions of site concentration allows us to state that the range of dense settlement of Danubian groups during their whole development period did not extend beyond the closest vicinity of a continuous loess cover (maximum 1.5-2 km), revealing close connection to the location and course of currently small watercourses, i.e. the Wyszmontów Stream in the east and the Przepaść and Krzczonowianka rivers – in the west. It seems that they were the key factor enabling the colonization of the zone of the Sandomierz Upland northern foreland outside the loessic regions, also determining the maximum range of successive periods of permanent settlement of Danubian communities. These streams constituted natural sources of water and food, and the bottom parts of their valleys could also have served as arteries for communication, used, among others, for economic purposes, including excursions to the natural resources outcrops. This is indicated by the data from the LBK settlement in Tominy, where the basic production raw material was Świeciechów flint, imported from outcrops located on the right bank of the Vistula (Szeliga 2008: Fig. 12).

A very important factor, stimulating the settlement processes of early-agricultural communities, was also access to suitably fertile soils (see Kruk 1971: 275–279; 1973: 144–146). In the case of the analysed area, this dependence is marked on the macro-regional level, revealing a clear correlation of the extent of permanent settlement with the zone of occurence of good and medium quality soils (Fig. 4). The distribution of sites within both microregions, however, does not reveal such a close correlation with the functional values of the local soil cover, comprising on the one hand – the areas covered with fertile soils formed on loess cover (western microregion), and on the other hand – with slightly less efficient, moderately good loessic soils (eastern microregion). This allows us to recognize the soil conditions prevailing in the settlement zone as undoubtedly significant indicator of the preferences of local early agricultural communities, nevertheless rather secondary to the hydrographic conditions.

Culminations and gentle slopes of small hills, located along the mentioned watercourses, were particularly preferred as the location of settlements, from the oldest phase of the Neolithic colonization of these areas, without revealing significant differences

also during the development of subsequent post-linear communities (Fig. 2A–B and 3). The location of settlements at the intersection of oak-pine and riverine forests enabled the exploitation of diversified environmental resources, both in the field of agriculture and breeding, as well as gathering and hunting. This is clearly confirmed in the archaeozoological material from Tominy, indicating, in addition to the importance of breeding, the very important role of hunting, conducted at the same time in various forest and treeless areas near the settlement. Penetration and agricultural exploitation of oak-pine and riverine forests areas are also confirmed by the archaeobotanical data, including both the diaspores of field weeds, as well as the taxonomically heterogeneous wood charcoals. The setting up of arable fields required the deforestation of at least a small area, through stubbing or burning. Light soils, easy to work, well lit and provided with water and nutrients were convenient for growing cereals (emmer and einkorn wheats).

The obtained results significantly complement and verify current knowledge about the scale and range of the settlements of the Danubian communities within the region of the Sandomierz settlement ecumene. They document the previously poorly known process of formation and functioning of the early Neolithic settlement clusters in the areas situated on the edges of the uplands, especially outside the range of compact loess cover, i.e. within the ecological-landscape zones that differ from the basic settlement preferences of early-agricultural communities (Sielmann 1971: 119–130; Kruk 1973: 72–76; Czekaj-Zastawny 2008: 98–104). The number and cultural diversity of the settlement relics discovered in the Wyszmontów Stream valley confirms the permanent and dynamic nature of this colonization of this region throughout the 6th and 5th millennia BC, revealing the significant position of this type area in the entire settlement system of the Danubian groups. The convenient, though specific, natural conditions of such areas and high adaptation abilities of the early-agricultural groups allow us to assume the existence of similar settlement concentrations, also in other areas on the borderland of loess uplands in the upper and middle Vistula basin. This can be confirmed by, among other things, the recent discoveries in the zone of the southern edge of the Vistula valley near Cracow (Zastawny 2014).

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Bronocice Funnel Beaker Vessel with Wagon Motif: Different Narratives

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Excavations at the Polish site of Bronocice uncovered a vessel with a wagon motif in a late Funnel Beaker pit that dates to 3405 BC and also contained animal bones, flint artefacts and potsherds typical of the Funnel Beaker phase BR III. This article introduces the Bronocice site, provides an overview of the Bronocice vessel and its imagery, and presents some of the significant interpretations of the vessel. It also briefly considers the issues inherent in interpretation of ancient imagery and suggests ways to avoid imposing modern paradigms on ancient imagery.

KEY-WORDS: Bronocice, Funnel Beaker, wagon, pottery, imagery.

The State University of New York at Buffalo and the Institute of the History of Material Culture, Polish Academy of Sciences (now the Institute of Archaeology and Ethnology, Polish Academy of Sciences) conducted a cooperative archaeological project at the Bronocice site, Świętokrzyskie province, between 1974–1978. The Director and Principal Polish investigator of this cooperative project was Witold Hensel; Sarunas Milisauskas was the Principal American investigator. Janusz Kruk and Sarunas Milisauskas served as the field directors. The project's objectives were twofold: (1) to investigate the prehistoric environments, chronologies, economies, settlement systems, and social organizations of the Middle Neolithic Funnel Beaker and Late Neolithic Funnel Beaker-Baden communities in the basin of the Nidzica River; and (2) to demonstrate the origin of complex societies in that region.

Bronocice was dominated by the Funnel Beaker and Funnel Beaker-Baden cultures during most occupational phases (Kruk and Milisauskas 1981a; 1981b; 2018; Kruk *et al.* 2018). Excavations uncovered a complex settlement pattern consisting of storage and refuse pits, collapsed structures, pit houses, ovens, fortification ditches, animal enclosures, human burials, an enormous assemblage of artefacts – including many

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ceramics – and faunal remains (Milisauskas and Kruk 2011; Milisauskas *et al*. 2016; Pipes *et al*. 2015; 2017). One unique find from the site has received extensive attention from archaeologists: a vessel with a wagon motif that was discovered in a late Funnel Beaker pit. The vessel is indirect evidence of the utilization of wagons in central Europe in the Neolithic. This find was included in Piggott's *The Earliest Wheeled Transport* (Piggott 1983) and in the German publications *Vierrädrige Wagen der Hallstattzeit* (Barth *et al.* 1987) and *Innovationswege – Wege der Kommunikation Erkenntnisprobleme am Beispiel des Wagens im 4. Jt. V. Chr.* (Burmeister 2011); it has since been considered in many additional publications (see e.g. Bakker *et al.* 1999; Bondár 2018) and serves as the focus of this article.

The Bronocice vessel was found in 1974 in pit 34–A1, which also contained animal bones, flint artefacts and potsherds typical of the Funnel Beaker phase BR III (3500/3400–3300 BC, chronology based on Bayesian analysis; Milisauskas and Kruk 1982; Kruk *et al.* 2018). In 1993, a bovine long bone found in the same level of the pit that yielded the vessel was radiocarbon dated to 4725+50 BP (GrN–19612). Its calendar age is 3637–3373 BC (2 sigma), and its median is calibrated to 3520 BC (Bakker *et al.* 1999; Kruk and Milisauskas 2018). This makes it approximately two hundred years older than the Late Uruk pictographs of carts from the Near East.

The Bronocice vessel itself is 10.5 centimetres high, has a rim diameter of 14.5 centimetres, and has a wall thickness of 0.6 centimetres. The incised lines that form its imagery are 0.1 centimetres thick (Fig. 1). The wagon motif – which Piggott describes as *the earliest dated instance of the conventional way of schematically rendering wagons in prehistoric art from the Atlantic coast to Central Asia* (Piggott 1983: 78–79) – is 1.8 centimetres wide and 1.5 centimetres long. It includes four wheels located at the corners of the wagon body, an additional circular element in the centre of this body that has been described as a "spare wheel" but may represent a vessel or ritual object, and a vertically extending handle or attachment; it appears three times on the surviving vessel surface. The imagery also contains three pairs of zigzag lines, two instances of a checkerboard-like pattern consisting of empty squares and sections made up of sets of short vertical and horizontal lines, and two vertical lines with short angled lines extending from each side. Two of the wagon motifs occur above ovaloid motifs made up of dots; the third is located on top of one of the pairs of zigzag lies.

A great variety of interpretations of these incised motifs have been presented. Although it is not possible to fully summarize all of these analyses in the space allotted here, a summary review of selected interpretations made by several scholars will be presented. Kruk and Milisauskas (Kruk and Milisauskas 1981b; Milisauskas and Kruk 2011) focus on the graphical form of the incised motifs and posit that the imagery represents trees (or a forest), agricultural fields, a road, and water (river). This combination of motifs is said to likely represent the everyday activities and beliefs of a Funnel Beaker community, particularly those pertaining to agricultural activities; similarities

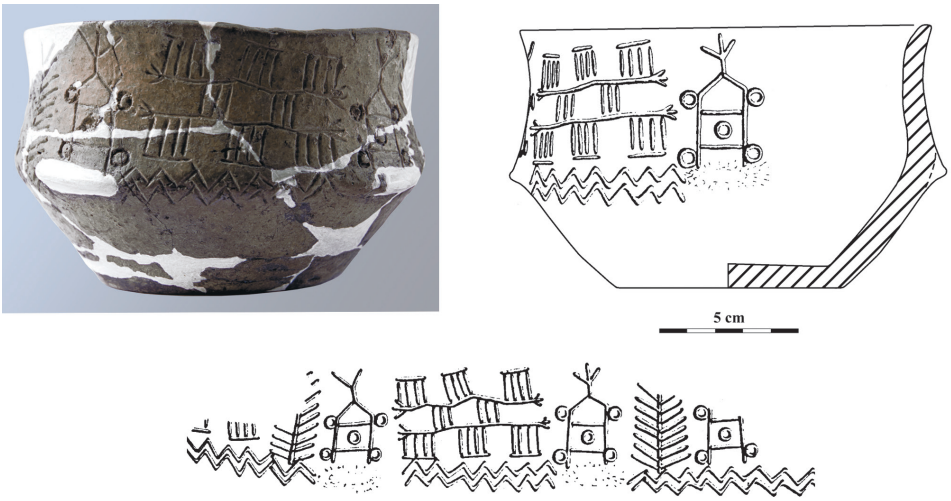

Fig. 1. A photograph of the Bronocice vessel (left) and a restoration drawing of its imagery, including a roll out view of the extant motifs (right; from Kruk and Milisauskas 2018, with modifications).

with motifs found among the Neolithic (Copper Age) rocks carvings at Val Camonica – which Anati (2008), Arcá (1997), and others have described as representative of cultivated land and domesticated animals – may support this interpretation.

Axel Pollex (1999) and Klaus Günther (1990) identify a more religious symbolism in the incised motifs. A. Pollex (1999: 547) suggests that cattle may be inextricably associated – both conceptually and symbolically – with wagons, noting that

> *[i]t is likely that in the Neolithic, cattle were important both for themselves and as a draught animals. They may have been valued as sacred animals; as an aspect of a deity; or even as a deity's embodiment. The bowl from Bronocice is a key find for the approach to the deity, because it shows the symbols of rain, water, cereal-ears or lightning. In addition, there is one symbol showing a four-wheeled wagon bearing a sun-symbol (Milisauskas & Kruk 1982:141, 1991: 565; Günther 1990: 61–2), suggesting that the wagon has a symbolic dimension.*

He further notes that *the Funnel Beaker clay discs and the Globular Amphorae ("sun-coloured") amber discs could be seen as sun-wheel symbols* and suggests that *[i]t is likely that the amber discs symbolize the sun, and the Bronocice bowl, "sun-wagon" and the "amber disc wheels", provide a possible parallel for the cattle-depositions* (Pollex 1999: 548).

Rafał Małecki (1995: 105) similarly emphasizes the religious and astronomic function of the incised motifs and suggests that *[t]he sun was regarded as a source of the power which fertilized the Earth, and these societies probably used solar calendar.* He further notes that *[o]ther features of the Bronocice drawing suggest its astronomic or calendric significance* and provides the following elaborated discussion:

> *Between the drawings of wagons are found three horizontal rows of 30 dashes, perhaps the number of days in a month? Two long horizontal lines have at each end three "prongs", giving in total 3 x 4 = 12, perhaps the number of months in a year? The universal nature of the drawing is reinforced by the representations of a tree, which may be linked with the rich symbolism of the Cosmic Tree and the cyclic rebirth of nature. The last element of the drawing is a double zigzag line near the base of the vessel. In the Mediterranean world the zigzag represented the water and fertility. It is not out of the question that such a symbol has a universal character* (Małecki 1995: 105).

In this view, the symbolic motifs from Bronocice offer an approach to the beliefs of the Neolithic people. K. Günther (1990: 65) posits a similarly religious interpretation of the Bronocice vessel that views the central circles on the wagon motifs as stylised representations of the sun and thus suggests that the sun – as the only sign decorating the wagon motif – played an important role and was probably symbolically pulled by cattle. Following this argument, wagon and cattle are cast as attributes to a deity which relates to the sun.

A different interpretive model has been developed by Xiang Wan, who suggests that *the wagon motif on the Bronocice pot shows striking resemblance to the Chinese character nán* 南 "*South*" *in the form of Oracle Bone inscription* (Wan 2011: 115). X. Wan attempts to explain their relationship by referencing the eastward migration of the Indo-Europeans; he also observes that the original form of nán 南 denotes a Kibitka-like wagon commonly depicted in Eurasian Steppe culture and notes that the a "*wagon*" *interpretation of nán is attested in Oracle Bone inscriptions, referring to vehicles drawn by cattle and goat* (Fig. 2; Wan 2011: 115).

In his discussion of how the wagon motif found at Bronocice might connect with the Chinese character nán 南, X. Wan suggests that *[t]he most straightforward interpretation is that the earlier one is the precursor of the later one, and the more pictographic one is the precursor of the more linear one*. (Wan 2011: 118). He further posits that, in this view, *the Bronocice motif may be seen as the precursor of the Chinese character* even though *the actual development of signs might be more complicated than suggested by this "Ockham's razor" approach. One might suggest more generally that the two images are reflections of a single scenario: wheeled transport along the Steppe* (Wan 2011: 118).

Additional interpretations of the Bronocice vessel can be found in popular culture. On the non-academic website Wikipedia, an anonymous author suggests that the motifs found on the Bronocice vessel *may represent a kind of "pre-writing"* symbolic

Fig. 2. Oracle Bone inscriptional forms of the character nán 南 "South" (from Wan 2011).

system that was suggested by Marija Gimbutas in her model of Old European language, similar to Vinča culture logographics (5700–4500 BC). The same anonymous source also offers more descriptive interpretation of the vessel's motifs:

> *[t]he picture on the pot symbolically depicts key elements of the prehistoric human environment. The most important components of the decoration are five rudimentary representations of what seems to be a wagon. They represent a vehicle with a shaft for a draught animal and four wheels. The lines connecting them probably represent axles. The circle in the middle possibly symbolizes a container for harvest. Other images on the pot include a tree, a river and what may be fields intersected by roads/ditches or the layout of a village.*

In the popular academic literature, David W. Anthony presents the Bronocice vessel as "unusual" and *not an accidental combination of normal decorative motifs*. He suggests that the incisions portray *a four-wheeled wagon, harness pole, and yoke* and asserts that *[t]he Bronocice wagon image is the oldest well-dated image of a wheeled vehicle in the world* (Anthony 2007: 67).

It is important to be cognizant of the inherently etic and interpretive nature of these and other analyses of the Bronocice vessel. It is similarly necessary to consider how they reflect conceptual and representational practices and principles of the cultural contexts of the interpreters – and thus are removed from the cultural contexts of those responsible for the vessel's creation. This does not mean that these models are inaccurate but instead underlines the need for critical approaches to the interpretive foundations and methodologies applied to the past. A critical examination of the accepted ranges of variability and degrees of similarity between ancient depictions and things extant based on stylistic principles used in contemporary representational contexts is thus crucial, since all interpretations risk imposing modern practices and understandings on ancient interlocutors in ways that can minimize their agency and be conditioned by modern theoretical or analytical paradigms.

At issue, therefore, is the notion of cultural grammaticality. Cultural grammars refer to the principles and patterns that structure and underlie cultural knowledge and norms, facilitate the recognition of semantically significant constructions, and allow for their interpretation within a particular cultural context; they are necessarily different across

both space and time (for an expanded discussion see e.g. Hudson and Henderson 2015; Hudson and Milisauskas 2017). Cultural grammaticality thus references the interpretability and semantic validity of a composition within a particular cultural context. The meanings recognizable in the context of creation may differ from those accessible to individuals who are geographically or temporally removed from this context. Avoiding the imposition of modern cultural grammars onto ancient ones in processes of interpretation requires deriving interpretations from data rather than approaching the data from the perspective of an expected or assumed outcome. This can be facilitated by structural approaches such as textuality, which consider the *fit between sign form and some larger context that determines its ultimate coherence* (Hanks 1989: 96; see also e.g. Hudson 2016; Hudson and Milisauskas 2017), particularly when such approaches are used as part of multivariate syntheses that also incorporate data from other archaeological and historical sources.

In the case of the Bronocice vessel, a textuality-based approach supports the identification of the wagon motif based on an analysis of the arrangement and compositional specifics of the elements that constitute it (e.g. the positioning of the four outer circles and vertical line) and the placement of these elements within the broader composition rather than on an assumed similarity to modern depictions. It also suggests that other motifs in the composition were conceptually associated with wagons and their function(s); the arrangement of their constituent elements and their positioning in the overall composition suggest the depiction of agriculturally-relevant items, particularly when considered in combination with archaeological evidence pertaining to agricultural practice at Funnel Beaker sites. This approach delineates a general domain of meaning but does not speculate about the broader implications of these motifs and offers no insights into their potential astronomical or religious associations.

We will never truly know what happened in the lives of the people who lived five or six thousand years ago at Bronocice, but in this article we have considered some of the possibilities and examined potential issues in the development of these interpretive frames. We want to emphasize that the invention of wagons played a significance role in transportation, economy, formulations of status, and ritual activity. While some focus primarily on the symbolism and possible ritualistic and mythological significance of the wagon motif, it is important to stress the technological and societal implications of the motif's existence. As D. W. Anthony points out, *[w]agons permitted herders to migrate with their herds into the deep steppes…for weeks or months at a time, relying on the tents, food, and water carried in their wagons.* (Anthony 2007: 461). These implications, and the implications of wagons for agricultural practice, are significant in their own right (Bogucki 1993). It seems that wagons appeared at about the same time in Europe and the Near East, and it is evident that technologically Europe was at the same level as the Near Eastern civilisations.

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English version by the authors

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Origin and Production of Silver in Early Medieval Poland

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Modern archaeology makes use of analytical methods in order to answer questions about deposit and technological provenience of artefacts. This paper discusses selected and the most interesting, results obtained during the completion of a research project which focuses on silver from the 10th and 11th centuries in Poland. In total, 200 silver artefacts known from Polish hoards (found in Kalisz-Dobrzec, Nowa Obra, Wolsztyn District, Zalesie, Olsztyn District, Słuszków and Jastrzębniki, Kalisz District, Kalisz-Rajsków and Stojkowo, Kołobrzeg District and Naruszewo, Płońsk District) were studied. A micro-invasion LA-ICP-MS (Laser Inductively Coupled Plasma Mass Spectrometry) was used for determinining lead isotope ratios in silver. The data obtained were evaluated using statistical methods which allowed reliable isotopic ratios in inhomogeneous alloy to be obtained. In order to study the provenance of silver, the obtained lead isotope ratios in the artefacts were compared with those of silver deposits. The use of SEM-EDX allowed the tracing of morphological changes and the measurement of quantitative elemental composition of coins, raw silver and jewellery according to technological traits.

KEY-WORDS: Silver in medieval Poland, SEM-EDX, LA-ICP-MS, lead isotope ratio analyses, statistical models.

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INTRODUCTION

During three years (2014-2017) a project was carried out that focused on attempts at defining the provenance of silver in Polish coins and West Slav jewellery discovered in deposits – hoards from 10th and 11th century Poland. The material from selected Polish hoards underwent analytic studies by elemental and lead isotopic ratio determination. This paper discusses results obtained for 60 coins, 26 jewellery artefacts and 25 pieces of raw silver. The coin assemblage contained Saxon deniers of Otto and Adelaide (10 items), cross deniers (3 items) from the Słuszków hoard and Polish coins – Palatine Sieciech's deniers (10 items from the Słuszków hoard), different varieties of cross deniers (27 items from the Jastrzębniki and Słuszków hoards). Furthermore, dirhams (10 items) from the Aš-šas, Ma'din and Andaraba mints from the Nowa Obra and Zalesie hoards were studied. The jewellery finds come from the Rajsków, Słuszków and Stojkowo hoards. Raw silver "cakes" were part of the Kalisz-Dobrzec and Jastrzębniki hoards, while bars were present in the Naruszewo hoard.

The use of non-invasive scanning electron microscopy with X-ray microanalysis (SEM-EDX) provided information about the elemental composition and structural characteristics in relation to technological aspects of the finds. However, the main goal of this project was to reveal the origin of silver which is connected with the study of lead isotope ratios as "fingerprints" of the artefacts and silver ores. The micro-invasive Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS; e.g. Dziunikowski 1998; Gale and Stos-Gale 2000; Pańczyk *et al.* 2015) was used to deterime lead isotope ratios. Until know only Pańczyk *et al.* (2015) have published results of a provenance study on medieval silver coins from Poland. However, in this work a different statistical approach was used than in the present paper. What Pańczyk *et al.* did was collect a series of isotopic data for one artefact and then average them. In our study we propose a new innovative approach consisting of taking into account all the measurement results per one artefact and then their statistical calculation, chiefly with the use of linear discrimination models. This eliminates improper historical inference being a result of the average of the measurements' value. The lead isotope inhomogeneity of a given artefact is an effect of several factors: I. use of re-melted metal from other artefacts (e.g., dirhams: Eniosova and Mitoyan 2011; Eniosova 2009; Merkel 2016) II. use of several ores and/or one ore which may be characterised by isotopic inhomogeneity (see Fig. 1); III. the use of lead from different places in the cupellation process (Merkel 2016). Therefore, one and the same artefact may display more than one lead isotope ratio value.

The origin of the silver which was in use in early medieval Poland is still largely unknown. There is literature and finds data that suggest the acquisition of ore from Germany (Harz Mountains), Czech and Slovak deposits, as well and Polish ores from the Dąbrowa Górnicza region (e.g., Rozmus and Bodnar 2004; Rozmus 2014;

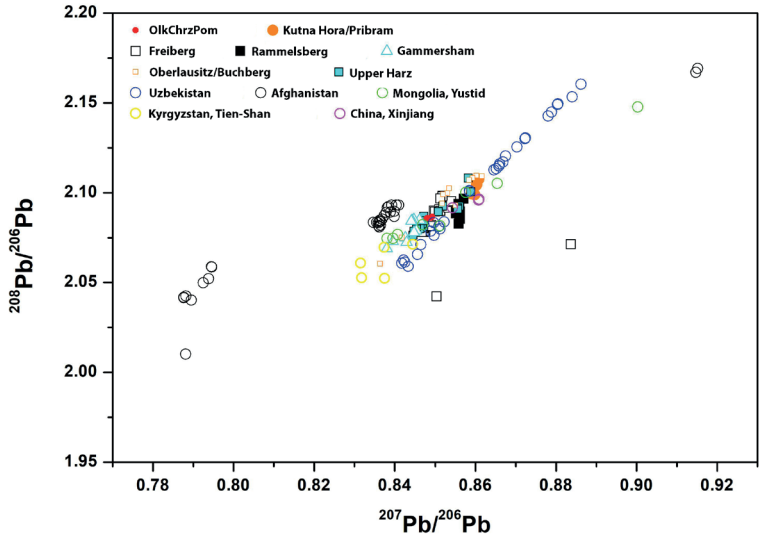

Fig. 1. Literature lead isotope data of ores presented as a $^{208}Pb/^{206}Pb$ and $^{207}Pb/^{206}Pb$

Garbacz-Klempka and Rozmus 2015; Merkel 2016). Furthermore, artefacts form the Middle East, especially dirhams, could have been used for re-melting (Merkel 2013, 2016; Eniosova and Mitoyan 2011; Eniosova 2009). The composition of hoards and loose finds show that silver reached Poland in the Early Middle Ages in three phases. To the end of the 10th century (Phase 1) there is a prevalence of oriental silver, that is Arab dirhams (Bubnova 1963; Burâkov 1965, 1974; Dekówna 1971: 496–487; Cowell and Lowick 1988). In the second half of the 10th century, Western European coins became more frequent in Poland. Then, the inflow of German coins prevails due to the discovery of silver deposits in the Harz region (Jammer 1952: 62; Suchodolski 1971: 22). The third phase is related to the period of rule of Bolesław Krzywousty (1107-1138) when raw silver dominates in hoards.

Generally, until now only basic issues concerning the attribution of silver artefacts (Kiersnowski 1960) are known. There is a direct relationship between coinage and authority in medieval Poland. Therefore, the study of such archaeological material must also take political issues into consideration (Suchodolski 1973; 2012). In the light of research results, one of the most interesting types of coins are the cross deniers with peculiar thickened edges (Kędzierski 1998; Kędzierski *et al.* 2011). These have been regarded as silver coins until now.

An interesting phenomenon in early medieval Poland is the presence of raw silver ingots, so-called "cakes". These finds are considered to be specific only for Poland

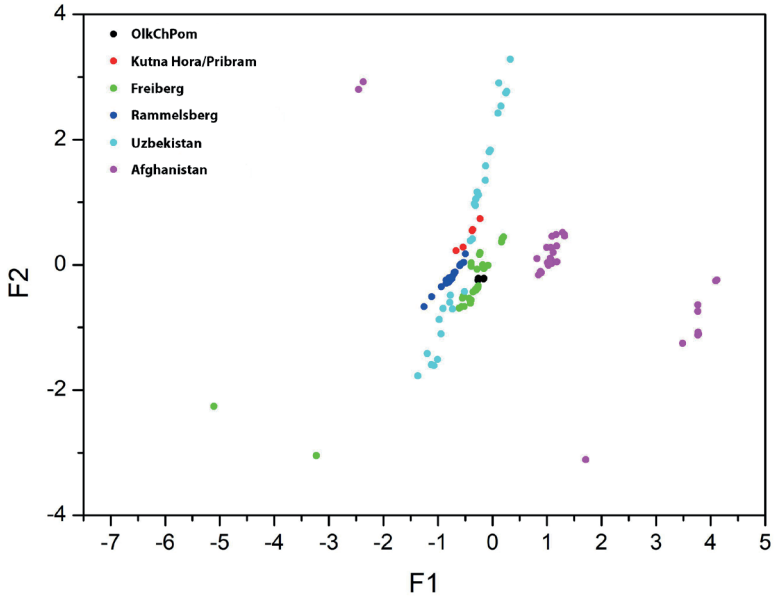

Fig. 2. LDA results for selected ores group (2 parametrs: $^{208}Pb/^{206}Pb$ i $^{207}Pb/^{206}Pb$, 6 grups). These deposits are historically significant in the analysis of the provenance of European artefacts. The data show a good separtaion by LDA model

(Rozmus and Tokaj 2009; Kędzierski 2011; Rozmus 2014; Garbacz-Klempka and Rozmus 2015; Kędzierski and Wyczółkowski 2017). Such a type of silver artefacts are discovered in some Scandinavian hoards, especially from Swedish Scania and these are obviously of Polish origin. On the other hand, typical Scandinavian raw silver, represented by bars, often provided with so-called pecks, appears in Polish deposits (Duczko 2002). Both types of raw silver were studied during our project.

Jewellery is a separate issue. The large assemblage of material recovered mainly from silver hoards– one of the largest groups of this kind of material in Europe – consists of female ornaments dominated by artefacts decorated with granulation and filigree (Duczko 1985). Typologically, they have late antique roots and they represent art developments within the former Roman province of Pannonia, reaching the highest level in the first Slav state of Great Moravia in the 9th century. After the fall of Moravia at the beginning of the 10th century, its jewellers moved to the rising Czech state of the Premyslids and to the east, to Swedish Rus (Duczko 2018). Ornaments produced in eastern and especially in western workshops can be found in Polish hoards. Such ornaments also appear in Scandinavian hoards (Stenberger 1958; Duczko 1972; 1985).

METHODOLOGY

The methodological approach is based on non- and micro-invasive techniques, which is a necessary trait in studies on archaeological finds.

Micro-invasive LA-ICP-MS allows the determination of lead isotope ratios in artefacts. Measurements were carried out using an ELAN 9000 Inductively Coupled Plasma Mass Spectrometer (Perkin Elmer SCIEX, Canada: www.perkinelmer.com) equipped with an LSX-200^{+} laser ablation system (CETAX, USA: www.cetax.com). The LSX-200^{+} combines a stable environmentally selected 266 nm UV laser (Nd-YAG, solid state, Q-switches) with a high sampling efficiency, variable 1 to 20 Hz pulse repetition rate and maximum energy up to 6 mJ/pulse. A NIST 981 reference standard material was used for quantitative determination of lead isotope concentrations with a standard deviation (SD)<0.1%. For each artefact n=40 measurements were carried out with SD<3% in series. Such sampling provided information about silver inhomogeneity. All obtained data were statistically processed in such a manner.

Morphological changes of the artefacts' surface were registered by scanning electron microscopy (SEM) as secondary electron (SE) images. Then, the elemental composition of such selected micro-areas was determined by X-ray microanalysis (EDX) up to a 4 μm depth for silver-copper alloy. For each micro-area at least n=3 measurements were carried out. Measurements were done using a Carl Zeiss EVO MA10 Scanning Electron Microscope equipped with an EDAX X-Flash Detector 5010 with a 123 eV spectra resolution (Zeiss Poland; www.zeiss.com) and provided with a Bruker Quantax 200 Esprit 1.9 system for analyses of EDX spectra. The image analysis was carried out using a secondary electron detector (SE) with a resolution up to 2.0 nm. Other parameters were the following: accelerating voltage 20 keV; measurement time: 120 s, LLD=0.1wt%. The current and field magnification was adjusted to the type of morphology of each studied surface. Quantitative analysis was done using the non-pattern method with an error <3% for main elements and <20% for trace elements below 1wt%.

The results of the elemental composition and lead isotope ratios obtained were processed using statistical methods, such as Linear Discriminant Analysis (LDA) and Principal Component Analysis (PCA). A supplementary method was Kernel Density Estimation (KDE) which allowed us to obtain a 3D model of lead isotopic ratio distribution in artefacts (e.g. Baxter 2003, 2016; Everitt and Hothorn 2011; see Fig. 3).

RESULTS AND DISCUSSION

Assessing the provenance

Fig. 1 offers a linear presentation of the results of lead isotope ratios for geological ores. $^{208}Pb/^{206}Pb$ and $^{207}Pb/^{206}Pb$ ratios were taken into consideration. The deposit isotope

data was mainly obtained from the literature (Hatz *et al.* 1991; Chiaradia *et al.* 2006; Pavlova and Borisienko 2009; Merkel *et al.* 2013; Ettler *et al.* 2015; Merkel 2016). These authors used an invasive mass spectrometry technique which produced averaged results in the sampling stage. Samples from Pomorzany and Olkusz mines were examined in the course of the project. Moreover, a sample from Dąbrowa Górnicza-Łosień (Rozmus 2014) was also analysed. In this case, the results are similar to those for the Pomorzany and Olkusz project samples, but are significantly at variance with the trend shown in Fig. 1. Therefore, only the data from the literature data eventually used in our provenance study. What is important, until now there is still a lack of an adequate data base (like OXALID: http://oxalid.arch.ox.ac.uk/, access on 25 April 2019) containing isotopic data for deposits which are important for the circulation of silver in the discussed period. Bearing this in mind, our provenance study based on available literature data has a pioneering character. Further provenance studies should be successively extended in relation to new available data and it is a matter of utmost importance to set up a freely available lead isotope data base.

Fig. 2 offers LDA (Kulczycki 2005; Šmit and Šemrov 2006) lead isotope ratio distribution for the discussed ores. Both Figs. 1 and 2 demonstate that there is a significant overlap in isotopic values for various ore deposits.

Fig. 1. shows that taking into account all literature data in a study of provenance of silver artefacts may be a source of confusion in further provenance studies This is due to the fact that isotopic "fingerprints" for deposits from different regions are similar or overlap. According to the results of the LDA analysis, group allocation, i.e., a relatively good isotopic separation is shown by deposits from Rammelsberg (85%), Uzbekistan (53%), Afghanistan (91%), Kyrgyzstan (80%) and China (67%). The largest degree of isotopic heterogeneity is exhibited by deposits from the areas of Freiberg, Oberlausitz, Upper Harz and Mongolia. Therefore, in further provenance investigation, only ore groups presented in Fig.2 as a LDA transformation were used.

As regards the LDA separation data presented in Fig. 2, the LDA allocation in groups in Fig. 2 is better after the removal of three strongly overlapping sets of data (Gammersham, Oberlausitz/Buchberg and Upper Harz) and ores from China, Mongolia and Kyrgyzstan which was used only to provenance study of dirhams. Namely, after the selection, the OlkChrzPom deposits shows an improvement from 40 to 100%, Kutna Hora/Pribram from 20 to 40%, Freiberg from 31 to 35%, and Rammelsberg from 85 to 96%. There is no change for Uzbekistan (53%), while the classification for Afghanistan improves from 91 to 94%. Only in the case of the Polish deposits (OlkChrzPom), Rammelsberg and Afghanistan, is the separation satisfactory. The deposit from Freiberg is the least homogeneous. Therefore, any provenancing classifications to this deposit are to be treated with care. The same applies to the Kutna Hora deposit.

Figs. 3 and 4 offer examples of the results obtained during the study on detailed isotopic variation in artefacts. An example of the lead isotope ratio distribution

including all n=40 measurements in one artefact can be seen in Fig. 3. Similar inhomogeneous isotope distributions were observed in all studied finds and this fact is connected with the possibility of use of different substrates and processes in silver production described in the introduction to this paper.

Due to the inhomogeneous lead isotope characteristics of the silver artefacts it is necessary to use statistical tools to interpret these results. Two approaches can be proposed. In the first one, the most probable value can be applied as a lead isotope ratio indicator. For example, in Fig. 3:b for $^{204}Pb/^{206}Pb$ it is the maximum value of 0.054 with error FWHM=0.003, while for $^{208}Pb/^{206}Pb$ it is the maximum value of 2.083 with error=0.211. This approach allows us to obtain one measurement value per artefact with an error corresponding to the FWHM for a series of n-measurements, as it can be seen in Fig. 3. Unfortunately, this does not take lack of homogeneity of alloys into consideration (see peaks with lower intensity in Fig. 3:b), and this inhomogeneity may be a result of the use of various sources and deposits. Besides, as it can be seen in Fig. 4, the coins alloy demonstrates (as it was the case with the deposits), a significant degree of lead isotope ratio overlapping.

Therefore, it seems appropriate to include into the calculation all measurement results obtained for one artefact. Then, the LDA analysis can classify this data to deposit values. In this way, we do not lose information about the possibility of use of several deposits and sources in the manufacturing process of artefacts by means of re-melting. In addition, we also take into consideration the isotope inhomogeneity of the ore deposits, which is shown in Figs. 1 and 2.

Tab. 1 presents LDA provenance study results obtained for Polish and Saxon coins, raw silver (cakes) and jewellery. The LDA analysis of the detailed isotopic variability in the group of Polish and Saxon coins seems to imply that they are made from metal coming from the same source (see Tab. 1). Furthermore, it is not possible to separate subgroups of silver sources in coin types which originate from these countries.

As can be seen in Tab.1, the dirhams from Northern Afghanistan (from the Andaraba and Ma'din mints) and dirhams from mints in Uzbekistan (the Aš-šas mint) fit very well within the deposit data available in literature (Merkel *et al.* 2013). A significant part of coin and jewellery silver is constituted by Central Asian bullion. On the other hand, the silver in these artefacts was also smelted from German (Fr, Ram) and Polish ores (OCP). In the coins and jewellery the share of the Czech ores (KHP) is slight which is in contrast to the raw silver. Cakes are mainly made of silver from Czech (25%) and Polish (33%) deposits, which is consistent with their identification as local semi-finished products (Rozmus 2014; Garbacz-Klempka and Rozmus 2015). However, they were not semi-products for the manufacture of the artefacts studied in the course of this project.

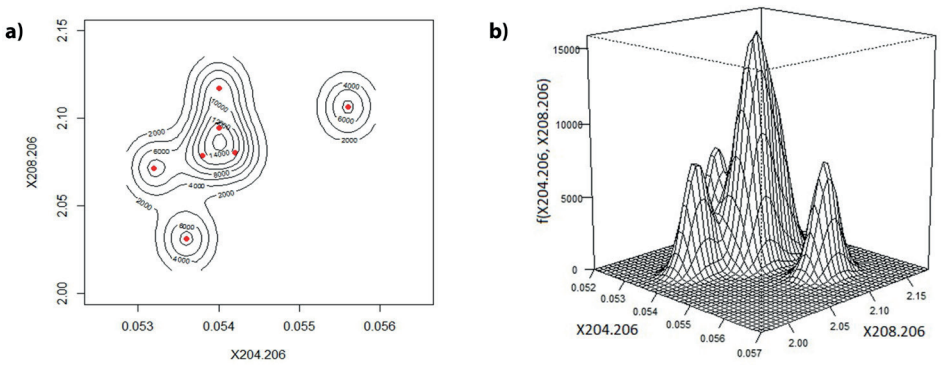

Fig. 3. Jewellery from the Zakrzew hoard. a) KDE contour plot; b) KDE 3d surface plot with the maximum value and error (full width at half maximum or (FWHM) of the peak) for the lead isotope ratios (X204.206, X208.206) obtained for all measurements.

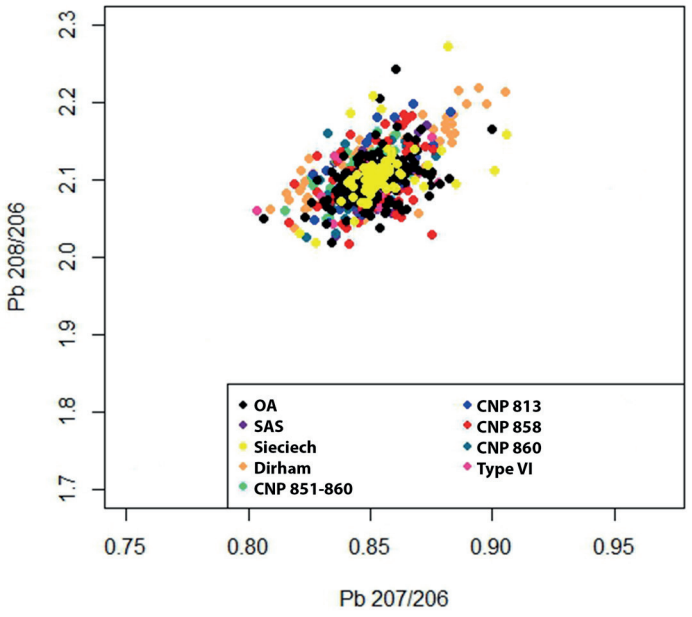

Fig. 4. Lead isotope ratio results presented as a 2d Pb^{207}/Pb^{206} and $Pb/^{208}/Pb^{206}$ diagram. Results for coins showing the most probable value for one artefact.
OA – Otto and Adelaide deniers, SAS – Saxon cross deniers, CNP – Polish cross deniers.

Table 1. Correlation matrix (LDA) for a set of artefacts and deposit data. Explanations: "no match" – no reliable allocation for the deposit group, lack of lead isotope data; the geological ores: KPH - Kutna Hora and Pribram; Fr – Freiberg, Ram – Rammelsberg, OCP – Olkusz Chrzanów Pomorzany, U – Uzbekistan, A – Afghanistan, M – Mongolia, K – Kyrgyzstan, Ch – China.

(%)	no match	KHP	Fr	Ram	OCP	U	A	M	K	Ch
Saxon coins	17	1	13	12	9	26	22	–	–	
Polish coins	18	1	10	12	10	27	22	–	–	
Raw silver (cakes)	33	25	1	8	33	–	–	–	–	
Jewelleries	19	2	11	12	8	25	24	–	–	–
Dirhams (from N. Afgh.)	40	–	–	–	–	6	29	5	16	4
Dirhams (from Uzb.)	79	–	–	–	–	16	2	–	–	3

Elemental composition analysis

During the elemental composition study of the coins, the following types could be distinguished: (i) coins from Asia (dirhams) with significant contents of lead up to 20%wt and bismuth up to 10%wt in micro-areas, (ii) typical coins with the main alloy components: silver up to 80%wt and copper up to 5%wt, and (iii) coins with element concentration anomalies on the surface that are characterised by an enrichment of copper and zinc in the coin core. This occurs in the case of cross deniers with thickened edges. Fig. 5 offers a distribution of the main elements in individual coin groups.

The results obtained during the present project are similar to those reported by Hensel for finds from the Ostrów Lednicki hoard (Hensel 2013). As can be seen in Figs. 5 and. 6, Otto and Adelaide deniers (OA) and dirhams show copper enrichment while Polish cross deniers demonstrate a higher content of zinc in the surface. This phenomenon is related to technological aspects of minting of cross deniers (Miśta and Gójska 2015; Miśta *et al*. 2016). Namely, corrosion loss was observed for some variants of cross deniers (CNP 813, 858 and 860) in the SEM–SE image. In these micro-areas a higher content of copper and zinc was observed. This indicates that that Polish cross deniers and also Palatine Sieciech's coins (as reported Kędzierski 1998) may have copper-based cores with addition of zinc.

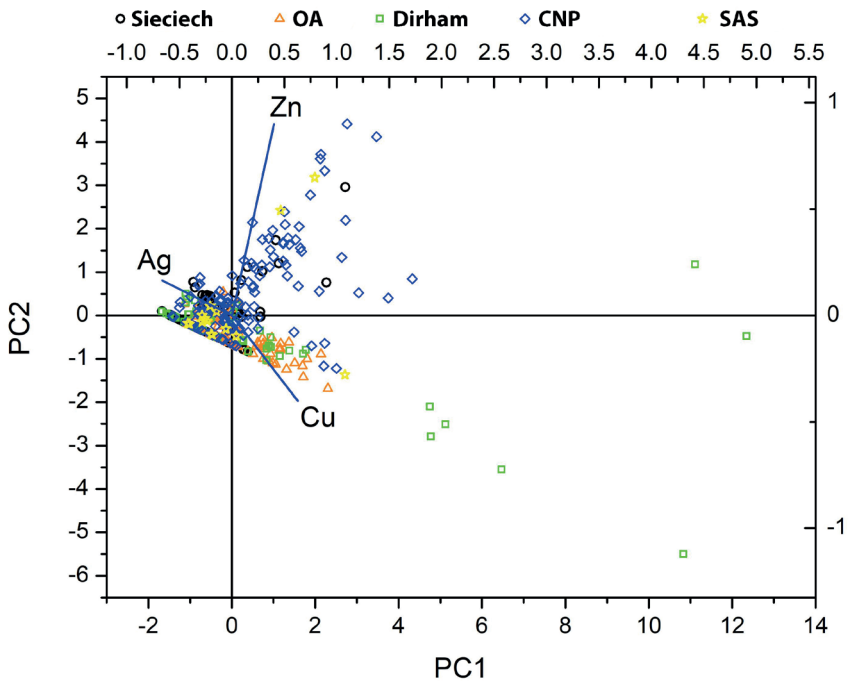

Fig. 5. PCA (correlation) results for silver, copper and zinc concentrations in different type of coins.

Fig. 6 presents the main elements' distribution in the silver alloy of different types of artefacts. Silver (Ag), copper (Cu), lead (Pb) and zinc (Zn) concentrations (wt% norm.) were taken into account in the studied types of artefacts.

For raw silver, we observed elemental concentration anomalies for the cakes. The SEM-EDX results show that the surface of some artefacts from this group is enriched in lead. There are micro-areas with a lead content up to ca. 67wt%. In the cross-sections of these artefacts, the lead content is ca. 6wt%, which is considerably higher than in the case of the coins and jewellery under study. This fact can suggest that lead surface enrichment in the form of oxides represents the remnants of an unfinished process of silver extraction from galena deposits (Garbacz-Klempka and Rozmus 2015). Moreover, the alloy of the cakes lacks a copper addition which also indicates that these were semi-finished products for the smelting of pure silver (Ashkenazi *et al.* 2017; Garbacz-Klempka and Rozmus 2015). As can be seen in Fig. 6, the bars are characterised by a different alloy with higher contents of zinc and copper.

During the SEM-EDX study of the jewellery, two technological areas were selected – the base alloy exposed on the surface, as well as areas of granulation and soldering.

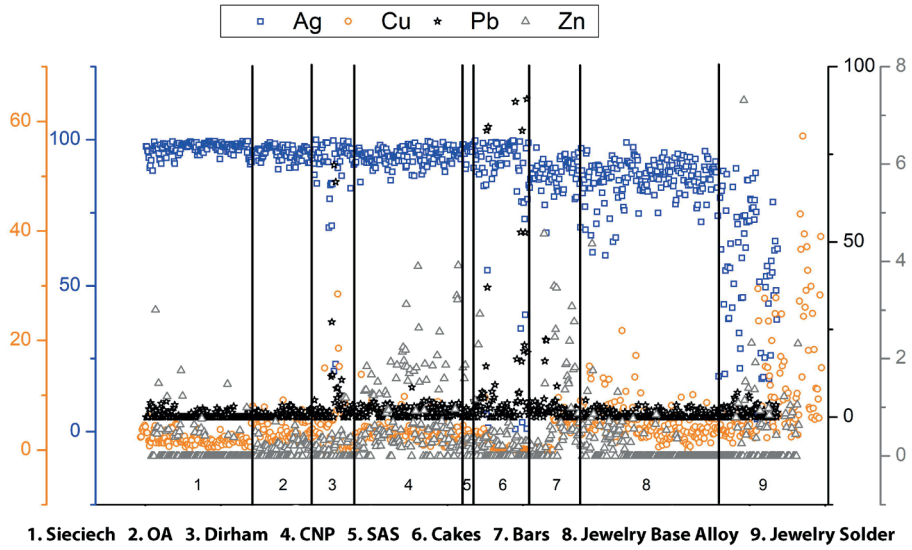

Fig. 6. Silver (Ag), copper (Cu), lead (Pb) and zinc (Zn) concentrations (wt% norm.) in the studied types of artefacts.

The latter has a different elemental composition, which is related to technological aspects. The soldering region shows copper enrichment related to a higher oxygen content and sometimes to the presence of low-melting elements such as antimony (Sb). The high oxygen content indicates the use of thermal treatment in the soldering process while the copper content in the solder may indicate the use of chemical bonding, such as the chrysocolla process (Duczko 1985; Demortier *et al.* 1999; Ashkenazi *et al.* 2017; Miśta-Jakubowska *et al.* 2019).

CONCLUSIONS

The present study on silver artefacts provides some clues for understanding silver circulation in early medieval Poland. A detailed analysis in terms of elemental compositions is a very difficult task. This is primarily due to the lack of homogeneity of the alloys and geological ores and also to a different production technology of each type of silver artefacts: jewellery, coins and raw silver ingots. The data collected during the project is still undergoing statistical processing. Since the analysed finds were produced by a series of anthropogenic actions (extraction of raw metal, recycling,

alloying with other metal) their structures are heterogeneous in the micro-scale. Thus, the obtained average elemental composition may be burdened with uncertainty (Liu *et al*. 2018). Therefore, the results should be analysed using advanced statistical methods without averaging results.

On the other hand, it can be said that some key information has been obtained during the research. The Polish and Saxon coins are made from the same silver source, which was based mainly on ores mined in Afghanistan, Uzbekistan and Germany. Furthermore, copper-based cores covered with silver sheets were discovered in the cross deniers. The same technology may have been used in the minting of Palatine Sieciech's deniers (Kędzierski 1998). Concerning their elemental and isotopic composition, North Afghanistan dirhams from Ma'din and Andaraba mints are similar. As is reported in the literature, ores from Panjhīr Valley were used in their manufacture (Cowell and Lowick 1988). All dirhams are characterised by higher content of copper, bismuth and lead in micro-areas of the surface. This indicates a low degree of mixing and admixture extraction. Furthermore, mainly Central Asian silver was used in the manufacture of the jewellery, as it has been reported by other scholars (Eniosova 2009; Eniosova and Mitoyan 2011; Merkel 2016). This metal may also have come from re-melted dirhams. A significant contribution was also made by Germany deposits located in Freiberg and Rammelsberg. The elemental composition and surface morphology study allowed to conclude that the ornamentation on the surface of the jewellery was made with the use of chemical soldering (Duczko 1985; Miśta-Jakubowska *et al.* 2019). The cakes called raw silver are characterised by different isotopic and elemental composition than the other artefacts studied. The results confirm the supposition that these are local semi-finished products, final products of extraction and the cupellation process from the ores. They lack copper admixture with a higher content of lead and their isotopic composition corresponds to Polish and Czech ores.

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