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T. MADEYSKA*, S. K. KOZŁOWSKI **
Warsaw

HUMAN SETTLEMENT AND PALEOENVIRONMENTAL CHANGES IN POLAND 20,000–8,000 YEARS AGO

Abstract

The paleoenvironmental changes in Poland during the Late Plenivistulian, Late Vistulian and the beginning of the Holocene are described basing on the results of the caves fillings and the fauna remnants study. The differentiation of vegetation in time and space documented in palynological profiles, is compiled and shown on some maps. Ranges of the pre-Allerød, Allerød and Younger Dryas human settlement belonging to different cultures are shown and discussed as well.

INTRODUCTION

The activity of hunter-gatherers over the time span 20,000–8,000 years ago did not generate any environmental changes observable in fossil evidence.

The problem in question is the variety of human response to the changes in the environment. One kind of the response is a cultural change – it means an adaptation for survival in new conditions by changes in tool inventories. The second kind of response is a migration of human population connected with a shift of their preferred ecosystem.

To find the solution to this problem, data concerning changes in vegetation and fauna as well as settlement ranges of particular cultural units are compiled in this article.

ENVIRONMENTAL CHANGES RECORDED IN THE CAVES FILLINGS

Direct information concerning the environment in which prehistoric man existed is obtained from examination of archeological cave sites. This is achieved by lithological analysis of sediments with the purpose of reconstructing conditions of sedimentation, as well as by the analysis of faunal remnants, preserved at these sites. The sediments which accumulated between 20 and 8 thousand years ago, are preserved in many rock-shelters and in caves, mostly near their openings. They have a thickness of several dozen cm and vary depending on the size and situation of the cave/rock-

* Institute of Geological Sciences, Polish Academy of Science, Al. Żwirki i Wigury 93 02–089 Warszawa
** Institute of Archaeology, Warsaw University, Al. Żwirki i Wigury 97/99, 02–089 Warszawa

shelter and the orientation of the opening (MADEYSKA, 1981). A series of autochthonous crioclastic limestone rubble and wind-blown loess originated during the Late Plenivistulian. If cave openings were suitably exposed to the wind, the loess formed clean and rubble-free lenses (Fig. 1 – layer 2, Fig. 2 – layers 2, 3, Fig. 3 – layer 3). The limestone rubble deposited during the Late Vistulian, sometimes in abundance (Fig. 1 – layer 3), is marked by a slight chemical weathering, which grows in intensity during the transition into the Holocene series. Simultaneously, in the fine material, the admixture of humus substances increases.

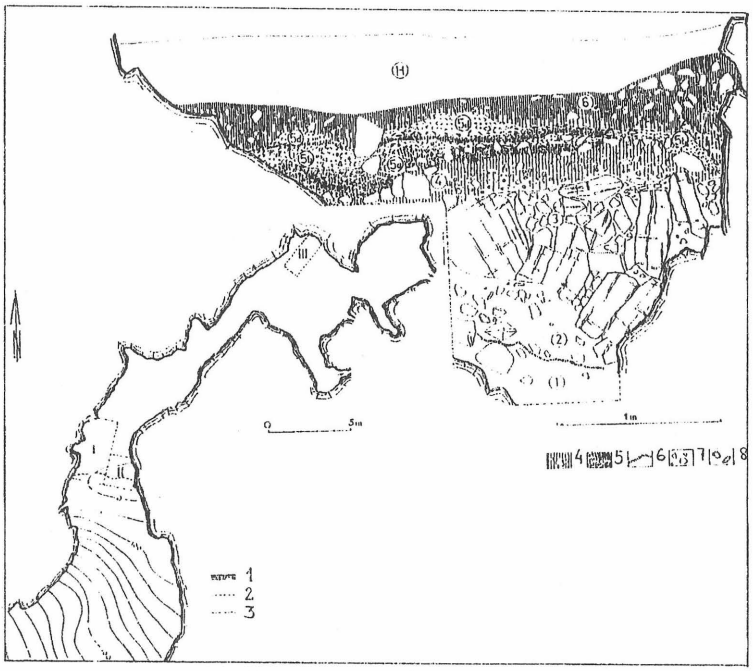


Fig. 1. Sąspowska Zachodnia Cave (Cracow Upland): plan and the cross-section of sediments (southern walls of the trenches I and II). Contour lines in centimeters below the primary level of sediments at the entrance

1. rocky walls of the cave; 2. drip line; 3. outlines of trenches; 4. humus with limestone rubble; 5. culture layers; 6. streaks of ferrugineous precipitations; 7. limestone rubble with loam; 8. fragments of dripstone; H - heap from the old trench (after T. MADEYSKA, 1988).

The remains of cave-dwelling vertebrates as well as the animal remains left by man, beasts and birds of prey, are very often found in the caves. They reflect, to certain degree, the composition of the ancient animal assemblages, and therefore reflect the conditions of the environment. The fauna of the period studied is characterized by a progressive change in the proportions of animal groups with various ecological demands. Such changes are shown (Fig. 4) on an example of two sites from the Cracow Upland. In column I the species spectrum of mammals is shown, in column II – the individual spectrum of rodents.

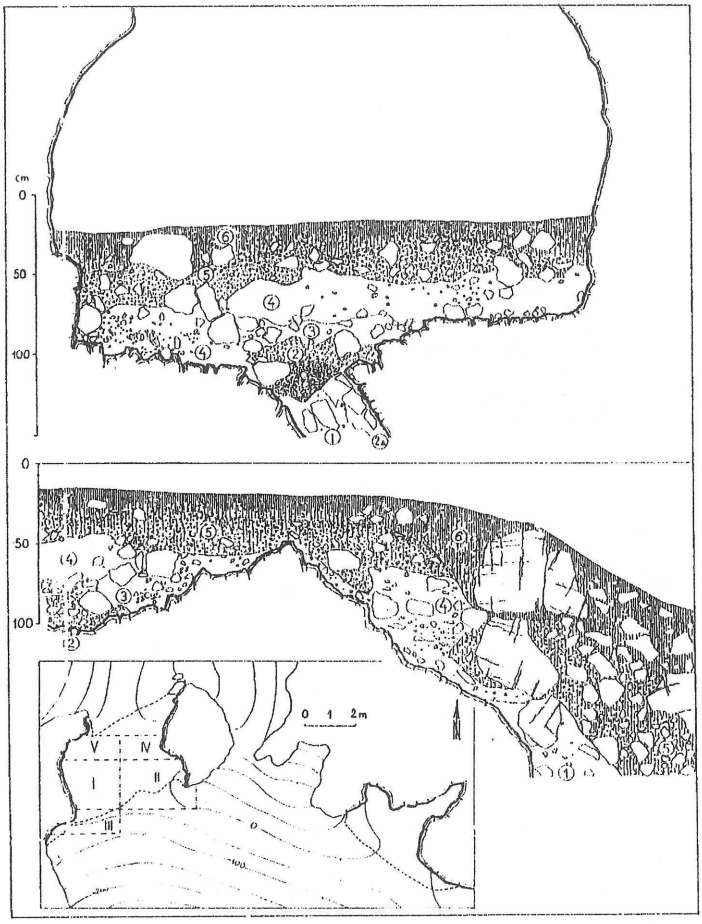


Fig. 2. Bramka Rock Shelter (Cracow Upland): plan and cross-sections of sediments. Upper one - northern walls of the trenches I and II, lower one - eastern walls of trenches I, III, V (after T. MADEYSKA, 1988). For the explanations – see Fig. 1.

On the basis of some dozen investigated cave sites in southern Poland (ALEXANDROWICZ *et al.*, 1992; BOCHEŃSKI *et al.*, 1985; KOWALSKI, 1989; NADACHOWSKI, 1976; CHMIELEWSKI, 1988) we can say that the differentiation of the sediments and fauna allows us to separate the discussed time span into only three periods: the Plenivistulian, the Late Vistulian and the Holocene. The smaller differences in sediment and fauna composition can not be interpreted univocally as equivalents of climatostratigraphic units. They were caused by local changes, differences in accumulation processes of the remains or by statistical errors.

In order to show the differences in faunal composition in the three mentioned periods, data concerning a presence of chosen, typical animals in some cave site sediments are compared in table I. The majority of

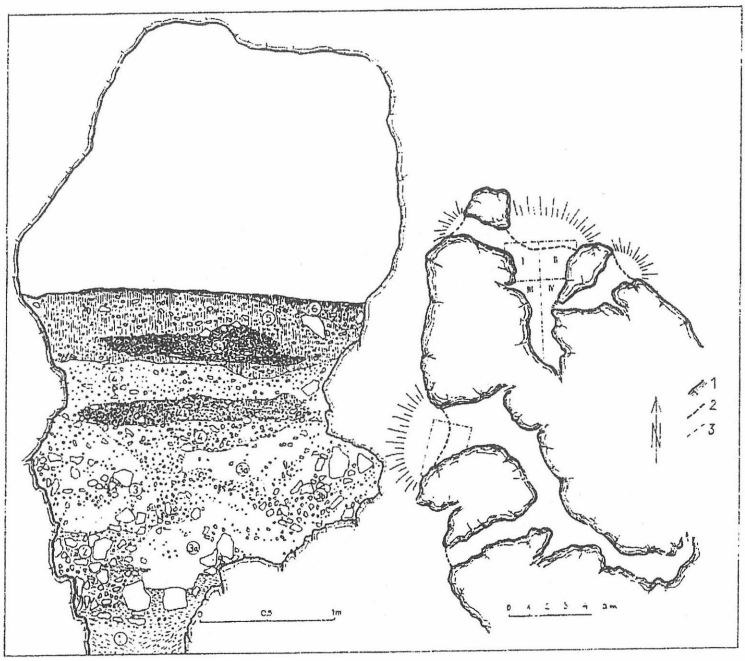


Fig. 3. Rock Shelter above the Niedostępna Cave (Cracow Upland): plan and cross-section of sediments in southern walls of the trenches I and II (after T. MADEYSKA, 1988). For the explanations – see Fig. 1.

rather numerous and almost always present eurytopic species, not closely connected with the particular environment, as well as such animals which occur sporadically, are omited. This comparison shows that in southern Poland, even in the Late Plenivistulian, side by side with quantitatively prevailing tundra elements, lived a limited number of animals connected with the forest environment or requiring at least groups of trees; steppe-animals also lived there. It proves the local differentiation of biotops, which resulted from mesoclimatic differences connected with the diversified relief in the investigated area (MADEYSKA, 1979, 1981). In the Late Vistulian many species of forest-animals appeared, the steppe-animals were more numerous than in the earlier period, but all tundra-species were still present. Landscape differentiation still existed, and only the acreages of particular biotops changed. A similar picture was obtained (BOCHEŃSKI, 1974; KOWALSKI, 1989) on the basis of differentiation of birds fauna, collected from the same caves in the southern part of Poland. Among the Younger Plenivistulian birds, those relating to the open landscape prevailed, but two species requiring trees are present as well. Nowadays, these birds nest chiefly North of Poland. During the Late Vistulian and the Holocene, the number of northern species decreased and those of the forest increased, together with species typical for the taiga. At the same time, the number of species nesting in Poland increased.

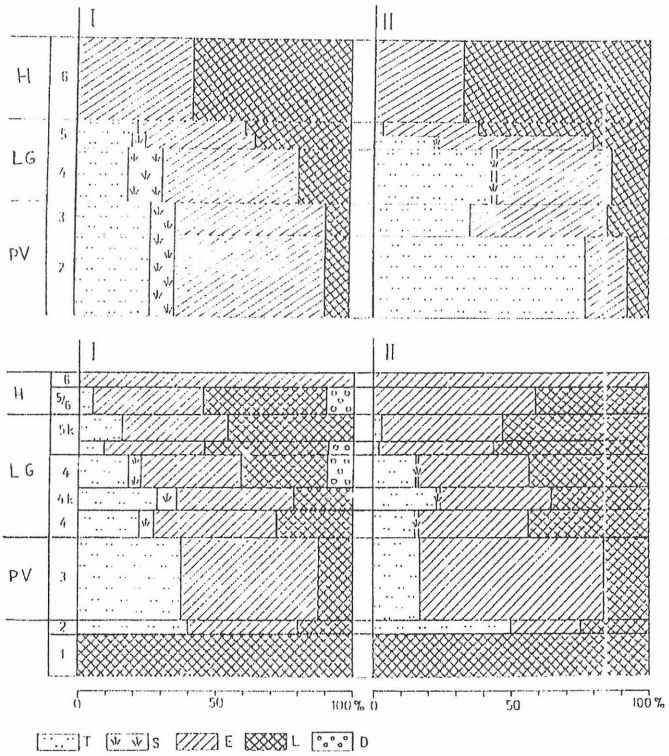


Fig. 4. Percentage composition of mammalian fauna from sediments of the Bramka Rock Shelter (upper one) and the Rock Shelter above the Niedostępna Cave (lower one) according to ecological requirements

I – percentage of mammalian species in ecological groups; II – percentage of rodent individuals in the same ecological groups; T – tundra elements; S – steppe elements; e– eurytopic elements; L – forest elements; D – domesticated animals. On the left hand side – numbers of layers are shown originated during the younger part of the Plenivistulian (PV), Late Vistulian (LG) and Holocene (after T. MADEYSKA 1981).

VEGETATION

According to L. STARKEL's (1988) reconstruction of the paleogeography of Poland during the maximum of the Vistulian Glaciation, the extension of the arctic desert zone south from the ice sheet margin, varied from about 50 km in the West to 150 km in the East. Based on various geological, geomorphological and paleontological data, he found the existence of two periglacial climatic provinces: "the criosemihumid one covering the Odra river basin and the Carpathians, and the criosemiarid one extending over the S-Poland uplands and subcarpathian basin". From this pattern he ascertained important diversity of geoecosystems in the southern part of Poland, inside zones of subarctic tundra, forest-tundra and tundra-forest-steppe. Patches of cold deserts and areas of deflation existed side by side with grass-shrub tundra and with enclaves of dense vegetation with trees.

The presence of selected animals characteristic for tundra, steppe and forest environments in the Younger Plenivistulian, Late Vistulian and Halocene layers of the caves fillings of southern Poland

Table I

SYMBOL OF SITE AND LAYER	TUNDRA								STEPPE					BISON	FOREST															
	Dicrostonyx gulielmi	*Lemmus lemmus*	*Microtus gregalis*	*Lepus timidus*	*Mammuthus primigenius*	*Coelodonta antiquitatis*	*Rangifer tarandus*	*Alopex lagopus*	*Cricetus cricetus*	*Cricetulus migratorius*	*Citellus superciliosus*	*Ochotona pusilla*	*Equus caballus*	Bos – Bison	*Apodemus sylvaticus*	*Apodemus flavicollis*	*Clethrionomys glareolus*	*Glis glis*	*Muscardinus avellanarius*	*Sciurus vulgaris*	*Sicista betulina*	*Capreolus capreolus*	*Cervus elaphus*	*Sus scorfa*	*Martes martes*	*Meles meles*					
Koz 1															+		+	+												HOLOCENE
TW 14																	+							+						
B 6															+		+	+	+	+				+						
SJN 6																								+		+				
SZ 4–6														+	+		+			+	+	+	+	+						
Zaw F–H															+		+	+												
Koz 2			+																											LATE VISTULIAN
TW 12–13														+			+			+		+		+						
B 4–5	+	+	+					+	+				+		+		+	+	+	+		+		+		+				
SJN 4–5	+	+	+	+					+					+	+		+	+	+	+		+	+	+	+	+	+			
SZ 3	+								+						+		+	+			+									
Zaw E	+		+			+	+	+					+				+													
Zal 7	+		+	+					+		+	+										+								
Obł 4	+	+	+									+					+													
Koz 6–3	+		+					+									+													PLENIVISTULIAN
Tw 11				+		+	+						+	+			+													
B 3	+	+	+											+			+													
SJN 3	+																+													
Mm 2	+	+	+	+	+		+	+	+		+	+	+	+			+				+									
Mm 2g	+	+	+	+			+	+			+	+	+																	
Mm VII–IX	+	+	+	+			+	+				+									+									
Zaw D	+		+			+		+									+													
Mos 5	+		+																											
Obł 6	+	+	+				+	+				+					+													

The data selected from: ALEXANDROWICZ *et al.* 1992, BOCHEŃSKI *et al.* 1985, MADEYSKA 1981, NADACHOWSKI 1976, 1988, NADACHOWSKI *et al.* 1989, VALDE-NOWAK *et al.* 1994. Symbols of sites: Koz – Koziarnia Cave, TW – Tunel Wielki Cave, B – Bramka Rock Shelter, SJN – Rock Shelter above the Niedostępna Cave, SZ – Sąspowska Zachodnia Cave, Mm – Mamutowa Cave, Zaw – Zawalona Cave, Zal – Rock Shelter in Zalas, Obł – Obłazowa Cave, Mos – Nad Mosurem Starym Duża Cave.

Thus, the Late Vistulian initial conditions for vegetation development were differentiated. Apart from the regional climate differences, distances from refuges were these conditions which differentiated the plant succession. A quick expansion of various communities on the upland areas was enabled by plants survival in the Southern Poland refuges during the Plenivistulian. An important factor was the breeding-ground. The succession on loess areas differed from that on wind-blown sands and dunes, in river valleys and from that on fresh post-glacial areas with morainic deposits rich with mineral substances. The existence of dead-ice blocks preserved on the territories freed from the ice sheet had also a big importance.

The vegetation of the older, pre-Allerød part of the Late Vistulian is documented in few palynological profiles. Several of them begun with the Oldest Dryas, no one is known till now, representing the Kamion (Epe) phase. It was evidently short climatic amelioration, too short for the development of vegetation corresponding with its thermic conditions. Probably the vegetation does not differ from that of the Oldest Dryas (MADEYSKA in print a).

Pollen data give local vegetation cover differentiation as well as some regional information. Due to the scarcity of information and uncertainty of dating, only the main pattern of regional differentiation of the vegetation formations could be concluded in some periods.

On the maps (Fig. 5), ranges of a few main types of vegetation are distinguished according to the palynologists interpretation of individual diagrams. Some information concerning the local vegetation cover is cited below.

In the famous dune-peat site Witów (WASYLIKOWA, 1964) the Oldest Dryas vegetation had the character of treeless tundra. Plants growing in damp places with willow and dwarf birches prevailed with an abundance of heliophytes in the first part of the Oldest Dryas, whereas during the second part, aquatic plants and those growing in dry places increased. It was the result of the water level rising in the lake. A similar picture of a dwarf-shrubs tundra existed in Dziekanowice (LITT, 1988) and Gopło (JANKOWSKA, 1980). This type of vegetation occupied the middle part of Poland. In the north-eastern part, freshly uncovered from the ice sheet, on raw, unleached soils, so called Dryas-tundra with pioneer plants developed and persisted up to the Allerød (site Mikołajki – RALSKA-JASIEWICZOWA, 1966). In the south-eastern part of the Polish Lowland (site Łukcze – BAŁAGA, 1990) patches of steppe vegetation with heliophytes developed in dry places, surrounded by shrub tundra in wet ones. In the upland area of southern Poland (e.g. Wolbrom – LATAŁOWA, NALEPKA 1987, Podłężówka – NALEPKA, 1994) tundra grew in damp habitats while in dry places heliophilous communities prevailed with isolated trees of birch, stone pine, larch and aspen. Higher in the mountains, arctic-alpine tundra prevailed.

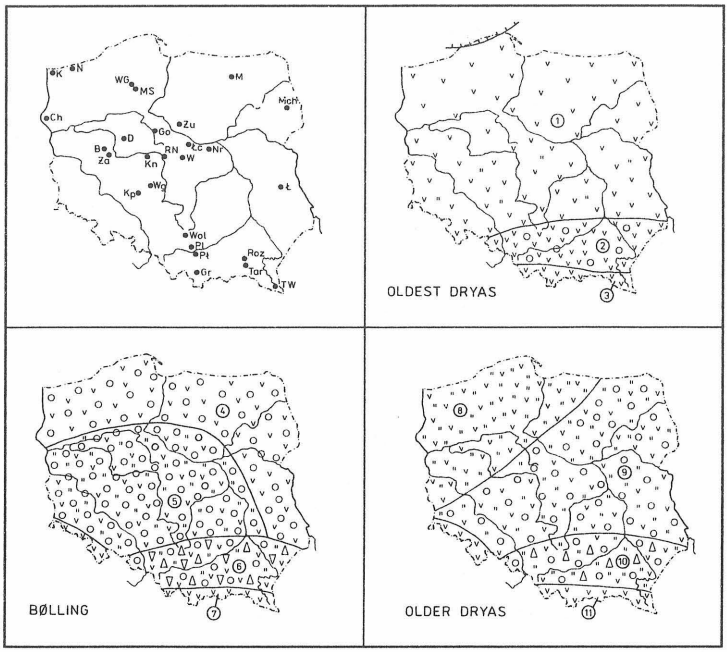


Fig. 5. Main pre-Allerød types of vegetation. Distribution of the Late Vistulian, pre-Allerød palynological sites

K – Kołczewo; N – Niechorze; WG – Wielkie Gacno; MS – Mały Suszek; M – Mikołajskie Lake; Mch – Machnacz; Ch – Chojna; Ża – Żabinko; B – Budzyńskie Lake; D – Dziekanowice; Go – Gopło; Żu – Żuchowo; Łc – Łąck; RN – Rośle Nowe; Kn – Konin; W – Witów; Nr – Nart; Wg – Węglewice; Kp – Kępno; Ł – Łukcze; Wol – Wolbrom; Pl – Pleszów; Pł – Podłężówka; Gr – Grel; Tar – Tarnowiec; Roz – Roztoki, TW – Tarnawa Wyżna; Oldest Dryas: 1. tundra with patches of steppe-like vegetation; 2. tundra with some trees; 3. arctic-alpine tundra; Bølling: 4. park tundra with birch; 5. open birch forest with aspen and important admixture of heliophytes; 6. open mixed forest with birch, aspen, larch, common pine, stone pine, with heliophytes and patches of tundra; 7. tundra with some trees; Older Dryas: 8. tundra with an abundance of heliophytes; 9. park tundra with birch and numerous heliophytes; 10. park tundra with some birch and coniferous trees, 11 – alpine tundra

During the Bølling period, the northern and eastern parts of Poland were covered by park tundra type vegetation with patches of birch trees (*Betula pubescens*) and possibly pine in places, in between areas occupied by tundra and steppe-like communities (e.g. Kołczewo – LATAŁOWA, 1989; Machnacz – KUPRYJANOWICZ, 1991; Łukcze – BAŁAGA, 1982, 1990). In the central part of the Polish Lowlands, open birch forest with aspen, and locally pine, dominated. Heliophytes still played an important role in dry areas while willows and dwarf birches still grew in wet places (e.g. Witów – WASYLIKOWA, 1964; Gopło – JANKOWSKA, 1980; Rośle Nowe – KRAJEWSKI, BALWIERZ, 1984; Węglewice, Żabinko – TOBOLSKI, 1966, 1988). The uplands of southern Poland were overgrown by open forest composed of birch and pine with aspen and larch. Damp tundra patches still grew on bogs (Wolbrom – LATAŁOWA, NALEPKA, 1987; Podłężówka – NALEPKA, 1994). In the

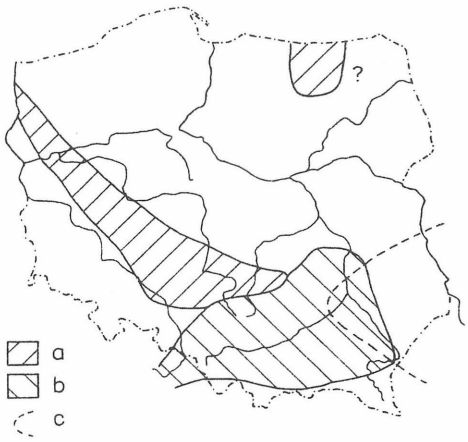


Fig. 6. Settlement of Magdalenian Period

a – Hamburgian; b – Magdalenian; c – Gravettian

Carpathians – open tundra communities with some coniferous trees prevailed (Grel – KOPEROWA, 1958, 1962).

Climatic deterioration and cooling of the Older Dryas caused the reduction of the importance of tree vegetation. The lake district of Northern Poland was then occupied by treeless shrub tundra with an abundance of heliophyte herbs (e.g. Wielkie Gacno – HJELMROOS, 1982; Dziekanowice – LITT, 1988). In the eastern part (Mikołajki – RALSKA-JASIEWICZOWA, 1966), well developed grasslands played an important role in that open landscapes, but shrub tundra with Dryas flora still existed in wet places.

Important part of the lowlands was occupied by mixed communities of park-tundra (BORÓWKO-DŁUŻAKOWA, 1961 a, b, 1969); KRUPIŃSKI, 1991; MIOTK-SZPIGANOWICZ, 1992; OSZAST, 1957; SZAFRAŃSKI, 1973; WASYLIKOWA, 1962). Birches were the main component of tree patches. Large dry areas were covered by heliophilous, xerothermic communities, in wet places shrub tundra played an important role (e.g. Gopło – JANKOWSKA, 1960; Węglewice – TOBOLSKI, 1966; Machnacz – KUPRYJANOWICZ, 1991).

The Uplands of Southern Poland were overgrown by open, park-like forest with birches, aspen, larch, common pine, and stone pine. Trees played a more (Tarnowiec, Roztoki – HARMATA, 1987; Wolbrom – LATAŁOWA, NALEPKA, 1987) or less (Podłężówka, Pleszów – NALEPKA, 1994) important part in these parkland communities. The higher parts of mountains were overgrown by treeless alpine tundra (Tarnawa Wyżna – RALSKA-JASIEWICZOWA, 1980).

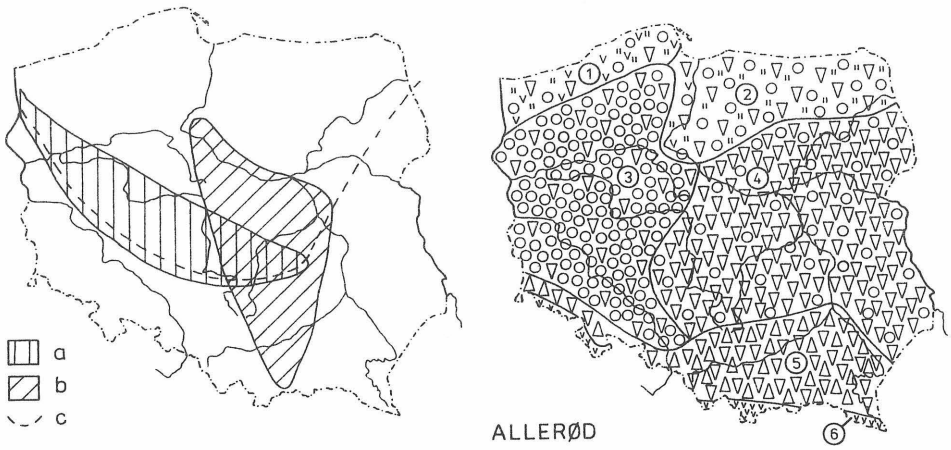


Fig. 7. Main types of vegetation (after MADEYSKA in print b, simplified) and settlement in the second half (climatic optimum) of the Allerød

1. open birch-pine forest; 2. open pine-birch forest; 3. dense birch-pine forest; 4. dense pine-birch forest; 5. coniferous forest; 6. alpine tundra and grassland; a – Federmesser Culture; b – Witowian Culture; c – Brommian Culture.

For the younger part of the Late Vistulian, namely the Allerød and the Younger Dryas, much more abundant paleobotanical evidence exists if compared with the older part of the Late Vistulian. Based on the paleobotanist's interpretation of particular palynological and macrofossil diagrams as well as on the analysis of the presence of some characteristic plants, the author constructed maps of vegetation for the optimal, younger part of the Allerød and for the coldest part of the Younger Dryas (MADEYSKA, in print b).

In the picture of the Allerød vegetation (Fig. 7) an increase of birch in relation to pine is seen towards the north-west or west as the result of increasing of climatic humidity. The improvement of the thermal conditions from the north to the south generates an enrichment of plant communities from poor open forest to coniferous forest rich in taxons. The more advanced development of soils in the south was probably the second factor inducing this enrichment as well as the existing of shelter habitats in mountains.

The important increase in the continental nature of the climate and cooling during the Younger Dryas (Fig. 8) resulted in the development of open communities and the reduction of woodland cover. Tundra elements were present mainly in the North where the oceanic climate influence was important and in mountains where there was a more abundant mois-

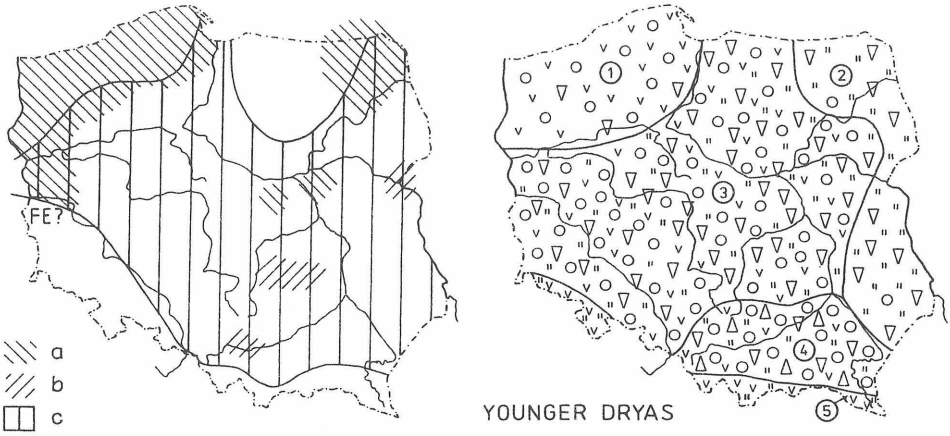


Fig. 8. Main types of vegetation (after MADEYSKA in print b, simplified) and settlement in the Younger Dryas

1. park tundra with patches of birch and small admixture of pine; 2. parkland with steppe–like grassland and pine; 3. forest-tundra-steppe with birch prevailing in the West and pine in the East; 4. open woodland with larch, stone pine and spruce besides common pine and birch and with patches of steppe-like grassland as well as tundra; 5. alpine tundra and grassland; a – Ahrensburgian and Volkushian; b – Desnenian; c – Swiderian; FE – Federmesser

ture supply. Steppe plants were an important component of open communities of the eastern and middle parts of the country.

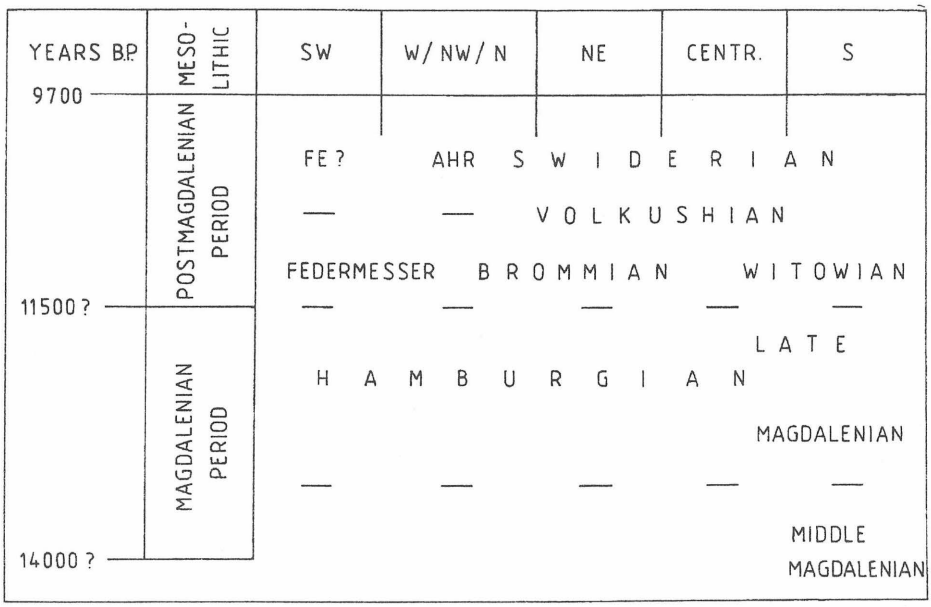
HUMAN SETTLEMENT

Traces of the human settlement in the Late Vistulian are known in Poland from numerous sites, mostly situated on sandy terraces and dunes, rarely in caves and rock-shelters or on plateaux. Unfortunately, their value is limited, they are rarely found in stratigraphic sequences and the organic material is almost absent, flint artefacts dominate. The dating of these sites is very difficult; about 20 radiocarbon dates are known from Poland, but only two Lowland sites (Witów, Całowanie) gave stratigraphic, radiocarbon and palynological evidence concerning the cultural sequence of this period. Fortunately, some cultural phenomena known in our country exist outside Poland; they have there their datations, and their material correlates with the Polish one (France, Switzerland, Belgium, Holland, Germany, Bohemia, Austria, etc.). According to these datations and the Polish ones, we are able to create the Middle-European Late Vistulian cultural sequence. Owing to these favorable circumstances, most of archeological material can be dated with help of typological comparative method and fitted into respective periods of a stated sequence. But the accuracy of such dat-

ing is of course limited. This Middle-European sequence is shown in the table II. It is also nesessary to say that serious gaps are observed in seemingly abundant material. The assemblages from earlier periods are not so numerous; this is partly caused by the less intensive settlement of these times, but also by covering of the older sites by younger sediments.

Chronology of human settlement in Poland during Late Vistulian

Table II



Hunter-gatherer communities of the Late Pleistocene, were strongly depending of the environment. Every big change of this environment provoked serious adaptation response, which means migration or change of culture. Aside the South-Polish Upland, the Lowland areas were exploited when they became accessible for game and man.

Sites concentrations were situated mainly in river valleys, rich with game, e.g. in gorges or confluences of rivers; drier grounds (morainic plateaux) were rather ignored for they provided little amount of protein. In general, a mobile style of life is stated, especially a seasonal changing of ecological niches conditioned by the game mobility. Aside of base camps, small satellite camps of short duration are observed as a result of brief hunting raids.

While the Polish Lowland was opened for various forms of penetration including the penetration from outer territories, the southern boundaries of Poland – especially the Carpathians – were impassable during colder seasons; in the Magdalenian period, the Moravian Gate was very important for communication purposes.

A question of the settlement continuity during the Late Pleistocene makes a really difficult problem. There is no reason for a statement that the settlement continuity really existed; such incertainty is caused by the mentioned lack of datings (Schild, 1975).

THE MAGDALENIAN PERIOD

A maximum of the Upper Plenivistulian can be described as a decline of the traditional Upper Palaeolithic settlement; the Gravettians left for the East or occupied territories situated southwards from the Carpathians; Poland become semi deserted. With few Late Gravettian sites (Cracow, Spadzista, Mamutowa Cave) but not a continuous settlement.

The first serious changes are observed in the Pre-Bølling/Epe interstadial, when the Middle Magdalenian culture hunters (Maszycka Cave) of the East French provenance, appeared near Cracow. They came from West and were the first wave of the expansion turning to a good account a relative settlement waste in the regrowing Middle-European oecumena (left by the Gravettian hunters). But the Middle Magdalenian settlement in our region is only a short episode without its local continuation. The earliest, relatively permanent settlement is the Late Magdalenian one, emerging at the beginning of the younger part of Oldest Dryas period on the southern territories of the country. At the same time, the similar settlement appears in Lower Austria, Bohemia, Moravia, Thuringia and Saxony (14–12 millenia BP). This phenomenon lasting in the Middle Europe, thus in Poland, till the middle of the Allerød, results from the activities of the forest-tundra hunters communities of West European origin. These reindeer and horse hunters penetrated the Central-European oecumena from the west, representing various models of the highly developed culture. Thus, the Polish materials are heterogeneous ones and resembling partly the Moravian and partly the Saxonian industries (Brzoskwinia-Ochoz-Byči Skala, Grzybowa Góra-Pékarna-Ölknitz, Sromowce-Žitneho-Etzdorf, Klementowice-Nebra). These multidirectional resemblances influenced a theory on the consecutive waves of western immigrants, reaching the Middle Europe in various periods of the long Late Magdalenian history.

The Late Magdalenian settlement continuity in Poland is not sure, it could completely vanish during colder periods and move to the South. This is suggested by relative poorness of the Late Magdalenian Polish materials; moreover, some of them work rather for Moravia than for the Little Poland; it concerns the sites which afforded jurassic flints (a mine in Wołowice in a vicinity of Cracow) and processed them (Brzoskwinia). So, in all probability, western parts of the Little Poland had been penetrated through the Moravian Gate seasonally and for supply purposes only. But it

doesn't refer to all Late Magdalenian settlement in Poland. More to the east it has its permanent settlements of the base camp type Grzybowa Góra, Klementowice-Kolonia, Mały Antoniów, Sromowce-Kąty. Some of these base camps, considering their size and richness of materials, were many times reoccupied by the same human groups, having their own social territories. The last is proved by the analysis of different flint raw materials used on these sites. In opposition to the mentioned big sites having their analogies in Moravia and Eastern Germany, there are small satellite sites (Krucza Skała, the Mników Gorge sites), traces of the small human groups activity. These groups left temporarily their base camps for definite purposes, e.g. the supply ones. Finally we have to say a few words on the extent of Magdalenian in our country (Fig. 6). This upland settlement is limited by the Carpathians on the south, and on the north reaches the southern part of the Lowland. The eastern and western borders are defined with a little accuracy. On the west, the settlement could reach the Lower Silesia (?), on the east approached perhaps the contemporary state border.

Almost contemporary to the Late Magdalenian settlement in the south, existed on the Lowland the Hamburgian settlement, beginning a little later (Bølling) and probably disappearing earlier. Scarce Polish Hamburgian sites (Liny, Olbrachcice) are the eastern periphery of a cultural phenomenon descending – like the Late Magdalenian – from the West European hunter's circle (but adapted to new environment conditions) which includes the Creswellian in NW Europe and the Hamburgian on the Lowland between Holland and Poland. The Polish sites are not numerous (only a few) and their character (location on sandy sediments) causes serious difficulties when we try to date them. The same difficulties concern the German and Dutch sites; only a few of them (Meiendorf, Poggenwisch, Stellmoor) served us with fauna remnants, which are dominated by the reindeer, rarely accompanied by the horse, more often by the hare. We are able to assume that the reindeer predominated also on our territories.

It is also necessary to mention single finds from the north-eastern Poland, the Kaliningrad region, Lithuania, as well as the lowland parts of Byelorussia and Ukraine. The first case concerns, among others, the reindeer's antler with incisions from Popówka Mała and a spindle-shaped point from Abstrutten. H. Gross dates these artefacts with a help of pollen analysis for the pre-Allerød period. The second case refers to flint points with angular back from Kašetos (Lithuania), Pribor (Ukraine) and Odrazhin (Byelorussia), which have their formal equivalents in the Hamburgian and Late Magdalenian. These artefacts could make traces of the Hamburgian penetration on the NE and East.

Finally at the beginning of discussed period, the south-easterly region of Poland still could stay in the Gravettian orbit. The site in Wilczyce near

Sandomierz gave the material nearing the Late Molodovian. It is possible to suppose that at this time the region situated eastward from the middle Vistula made the border zone between the Late Magdalenian and Late Gravettian (BURDUKIEWICZ, 1986; KOZŁOWSKI, KOZŁOWSKI, 1977; KOZŁOWSKI, 1989, KOZŁOWSKI in print; SCHILD, 1975).

THE POST-MAGDALENIAN PERIOD

The Late Magdalenian culture disappears in the 12-th millenium BP, undergoing sharp transformation in the Allerød period. Among the reindeer and horse hunters communities populating upland regions the multidirectional adaptation changes are observed, conditioned by serious ecological changes. So, between the Pirenees and Russian Lowland, the tundra and cold steppe are gradually replaced with a forest; the tundra formations move towards North. Supposedly, the upland Magdalenian settlers migrate to the less penetrated lowland environments, while non-Magdalenian groups come northwards from the southern central Europe following the expanding forest. In the chipped industries of this time serious changes are observed (miniaturization), probably conditioned by the adaptation to the Lowland's flint raw material pooreness. Finally, these complicated and poorly known processes resulted with formation of two big technocomplexes (the middle of the Allerød); the first is characterized by arched backed points and short end-scrapers, the second – by tanged points. The ABP complex is rather meridional and forest phenomenon and its origin could be bounded both with the Mediterranean tradition but with the Magdalenian one as well. In Europe, the ABP is represented by the Azilian, Federmesser or the Late Creswellian as well as by the Mediterranean Epigravettian elements. Supposedly, in Poland, at least three variants of ABP complex are represented (Fig. 7):

– More western connections (the presence of the Federmesser backed pieces) have two units having their place inside the Federmesser convention. To the Rissen group belongs the Wołczkowo site, to the Tarnovian group (Tarnowa, Lubiatów) belong several sites from Western and Middle Poland.

– The Witowian show southern connections, its points are dominated by the short, asymmetric arched backed pieces, which have their best analogies southwards from the Carpathians. The Allerød chronology (probably the second half, a connection with the Usselo soil) is generally accepted for the Federmesser groups, which come down from the Magdalenian stock. Locally they could remain a little longer (especially on the South-West); this is suggested by the sites connecting backed and tanged points (Lubiatów II and III, Wojnowo ?, Wapiennik). The Epigravettian (Witowian)

groups are precisely dated, to the second half of the Allerød period (Witów, Całowanie). But they could survive longer (e.g. the presence of the backed points in Witów concentration II).

The tanged points complex (TPC) is a northern neighbour of the ABP complex and mostly is connected with the tundra region. In the Middle-Europe measures the particular parts of this complex are the following units: Brommian, Ahrensburgian, Volkushian, Swiderian/Masovian and Desnenian. The scarce fauna finds connected with TPC sites (Stellmoor, Bromme Remouchamps) suggest that the TPC hunters were bounded with the reindeer and, to a certain degree, with the elk. The most typical tool forms of TPC are the flint arrowheads with tang as well as single-barbed and double-barbed harpoons.

In the second half of the Allerød, thus, on the beginning of the post-Magdalenian period, three archeological cultures are known from Poland. The northern region is occupied mainly by the tundra hunters of the Bromme culture, which, in North-Eastern Poland is called Perstunian. Scarce Federmesser sites (in Rissen and Tarnovian variants) settle down on the West. The Witowian makes third element and is placed in upper and middle Vistula river-basin. All mentioned cultures are a logical territorial continuation of the cultures known from outside Poland. The Bromme sites are known from northern Germany, southern Skandinavia and northern part of the Russian Plain. The Federmesser culture occurs on the German Lowland, in Holland and Bohemia, while the elements similar to the Witowian occur in Moravia, Slovakia, Hungary, and in Lower Austria. During the Younger Dryas, the tanged points cultures extent to South, the Federmesser elements exist only in the South-West (?), while the Witowian perhaps in the South (?). The Brommian disappears, evolving in the northern outskirts of the country and, in the West, towards the Ahrensburgian (known from Germany, Belgium and Holland, but also Pomerania), while, on the East, towards the Volkushian (NE Poland, Lithuaina). All this took place very likely during the first half of the Younger Dryas (cf. also the Pre-Masovian industry from Całowanie, layer V, similar to the Volkushian).

Later, between the Pomeranian moraine and the Carpathians (Fig. 8), the Swiderian/Masovian culture emerges (the second half of this period according number of radiocarbon dates and stratigraphic evidence from Całowanie). On the East, this phenomenon reaches the Dniepr river. The Ahrensburgian and Volkushian elements still exist in the Late Younger Dryas on the north and west of the country paralelly to the Swiderian on the south and the east. Additionally from the East, the Desnenian elements emerge (Witów, concentration II, Jacentów, Grzybowa Góra). All mentioned taxonomic units are left by the mobile reindeer hunters and their disappearance can be dated about 9,800–9,700 years BP. The Early-Holocene Mesolithic cultures emerge in Poland later. On the majority of our terri-

tory, Mesolithic is represented by the Komornician (GINTER, 1974; KOZŁOWSKI, KOZŁOWSKI, 1977; SCHILD, 1975, 1984; SZYMCZAK, in print).

CONCLUSION

1. The Late Plenivistulian climatic cool caused the Upper Palaeolithic (Gravettian) settlement shift, eastwards and southwards from the territory of Poland. But, the Southern Poland was not total anecumena during the time. Here and there, the steppe-tundra with trees survived in the favorable landscape and mesoclimatic situations. It helped to survive such animals like reindeer, mammoth, hairy rhinoceros, the blue hare and arctic fox. Scarce human groups penetrated occasionally Southern Poland coming from the south and east looking for flint raw materials.

2. During a short climatic amelioration of Kamion (Epe, pre-Bølling phase), which is not confirmed by a distinct vegetation change, the Middle Magdalenian hunters appeared shortly near Cracow coming from the west.

3. During the time span beginning with the Oldest Dryas decline, through the Bølling and Older Dryas, till the first half of the Allerød, when the territory of Poland was covered with the open forest, forest tundra and tundra of varied acreages (Fig. 5), the South Polish Upland was inhabited by the Late Magdalenian hunters. In the Western and Middle Poland, where the landscape was more opened if compared to Southern Poland, the Hamburgian culture human groups lived during the Bølling and perhaps Older Dryas periods.

4. The new cultures emerged in second half of the Allerød, when the majority of Polish territories was covered with forests (Fig. 7). The hunters of the Federmesser culture lived in the west, while the middle and upper Vistula river-basin was inhabited by the people of the Witowian culture. The northern part of the country was penetrated by the Bromme culture hunters. On this territory, even during the optimal part of the Allerød, the open landscapes with tundra elements survived.

5. In the Younger Dryas (Fig. 8), as the forest extent diminished and the steppe-tundra vegetation acreages grew, the Federmesser and Witowian culture settlement extent was reduced, while the new cultures of the reindeer hunters developed: the Swiderian in Middle, Southern and Eastern Poland, the Ahrensburgian on the North and West, the Volkushian in the North-East.

6. The early Holocene forest development is followed by the appearance of new Mesolithic cultures.

Translated by Barbara Kołodziejczyk

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