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Studies on Pleistocene and Holocene mammals from Poland: The legacy of Edward Feliks Lubicz-Niezabitowski (1875–1946)



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This work is dedicated to the memory of Edward Feliks Lubicz-Niezabitowski, in appreciation of his enduring legacy to research into the remains of the Pleistocene and Holocene mammals from Poland.

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ABSTRACT

This paper presents the legacy of Edward Feliks Lubicz-Niezabitowski, a Polish scientist, biologist, zoologist, and physician who, over 20 years, collected and studied the Pleistocene and Holocene mammals found at various sites in Poland. A synopsis of his achievements in this regard is presented here for the first time, and covers representatives of Elephantidae, Rhinocerotidae, Cervidae, Bovidae, Equidae, Carnivora, and Rodentia, dealing with the locality and context of the finds, as well as the specific elements they represent. Although it is difficult to evaluate how many specimens of those specified by Lubicz-Niezabitowski are preserved to this day, and to what extent, the collected data can be used for synthetic works concerning diversity and occurrence of Pleistocene mammals in Europe, with reference to Poland.

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“Vita mortuorum in memoria vivorum est posita”—The life of the dead is placed in the memory of the living (Marcus Tullius Cicero).

1. Introduction: the scope of Lubicz-Niezabitowski's research

Edward Feliks Lubicz-Niezabitowski (1875–1946) was a Polish scientist, biologist, zoologist, and physician. In the years 1928–1929, he served as *Rektor* (Chancellor) of the University of Poznań.

His scientific achievements include about 150 works in medical and natural sciences, and in topics as diverse as entomology (Lubicz-Niezabitowski, 1902), zooarcheology (Lubicz-Niezabitowski, 1924a, 1928a, 1929a, 1933/1936, 1938a, 1939a, 1939b, 1939c, 1939d), and the study of modern vertebrates (Lubicz-Niezabitowski, 1901) and Pleistocene mammals, which are listed in details below. His work provided knowledge of morphological and morphometric issues and zoogeography, along with environmental aspects of animals. At the same time, he also dealt with issues of natural protection (Lubicz-Niezabitowski, 1928b, 1930). His contribution to the methodological aspects of the study of mammalian fauna was to develop a “Key to the

determination of vertebrates of Poland” in 1933 (Lubicz-Niezabitowski, 1933a). He wrote and published not only in Polish, but also in French and German, which was uncommon at that time.

His legacy includes not only articles, but also several series of monographs and chapters on mammoths (Bayger et al., 1914), rhinos (Bayger et al., 1914; Lubicz-Niezabitowski, 1926), moose (Lubicz-Niezabitowski, 1929b), and European bison (Lubicz-Niezabitowski, 1931). A separate categories of his studies is represented by the analysis of animal bones from archaeological sites—such as Neolithic settlements in Rzucewo (Lubicz-Niezabitowski, 1928c) and Dębiec near Poznań, now the Poznań district of Dębiec (Lubicz-Niezabitowski, 1932a).

As his research belongs to the period of the World Wars, it is difficult to quantitatively and qualitatively assess the surviving state of his specimens. In this context, his published works (most of which have good illustrations of the specimens), constitute an invaluable source of information from the first half of the century.

The purpose of this paper is to present the legacy of Edward Feliks Lubicz-Niezabitowski in the form of published results of his studies of Pleistocene-Holocene mammalian remains found at various sites in Poland, apart from a few cases in Ukraine. The study of the remains of woolly mammoth, straight-tusked elephant, woolly rhinoceros, giant deer, Eurasian elk, European bison, steppe wisent, reindeer, horse, Eurasian cave lion, and cave bear was an essential part of his research. The collected data, which constitute the first such summary of his achievements in this regard, can be

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used for synthetic works concerning diversity and occurrence of Pleistocene mammals in Europe, with reference to Poland.

2. Lubicz-Niezabitowski's contribution to research into Pleistocene–Holocene fauna

The collected results of Lubicz-Niezabitowski's analyses of fossil remains show the taxonomic diversity of mammals. Among others, he identified remains of woolly mammoth (*Mammuthus primigenius*), straight-tusked elephant (*Elephas (Palaeoloxodon) antiquus*), woolly rhinoceros (*Coelodonta antiquitatis*), giant deer (*Megaloceros giganteus*), Eurasian elk (*Alces alces*), European bison (*Bison bonasus*), steppe wisent (*Bison priscus*), reindeer (*Rangifer tarandus*), horse (*Equus* sp.), Eurasian cave lion (*Panthera leo spelaea*), and cave bear (*Ursus spelaeus*) (e.g., Lubicz-Niezabitowski, 1912a, 1914, 1925, 1926, 1929b, 1935, 1948a). A significant number of specimens came from sites in Poland, and some of the fossil remains originate from contemporary Ukraine. In peatlands, especially in the Polish regions of Wielkopolska and Pomorze, complete skeletons of elk, bison, aurochs, and deer were found *in situ*, as well as redeposited skulls and bones of these animals (Lubicz-Niezabitowski, 1933b).

In addition to species of the main interest, Lubicz-Niezabitowski (1932b, 1933a) also mentions a number of species from other genera from Mammutowa Cave near Ojców (Wierzchowie, Mammutowa cave according to Kowalski, 1959). These genera are *Lepus* (also from Okiennik Cave near Ojców), *Ochotona*, *Arvicola*, *Microtus*,

The study included both geological and palaeobotanical analysis, and covered vertebrates (*Mammuthus primigenius*, *Coelodonta antiquitatis*, *Bos primigenius*, *Bison priscus*, *Equus* sp., *Cervus elaphus*, *Microtus arvalis*, *Apodemus sylvaticus*) and invertebrates from two sequences of sediment: lake sediments from the Boreal period (layers 7–10) and those from the last glaciation (layers 4–6). Layer 4 of the latter appears to be of particular interest: it consist of sands with cross-bedded stratification, in which the bones of animals have been found, along with two flint tools (Lubicz-Niezabitowski, 1929c).

This paper does not attempt to verify the descriptions of the specimens, but instead provides a summary based on the sources available in the bibliography. All of his published and accessible analyses of fossil material were used here to prepare a faunal list specified for each taxon, reconsidering the names of sites, which have in some cases been renamed, due to geographical updates. Only Holocene remains from the sites, which were not part of the archeological settlement complex, were taken into account here. The current storage locations of the specimens have not been checked. However, an attempt was made to find specimens in the collections of the author's institution (Institute of Geology, Adam Mickiewicz University), which turned up certain of the specimens, such as the woolly rhinoceros skull fragment. The year of discovery of each specimen is not known in all cases; where unknown, Tables 1–12 give an indicative date that precedes the publication of the find.

Table 1

Elephantine remains from Lubicz-Niezabitowski's research. Abbreviations: E.a. – *Elephas antiquus*, M.p. – *Mammuthus primigenius*, M.t. – *Mammuthus trogontherii*, E.t. – *Elephas trogontherii*. The original nomenclature has been preserved.

	Localities (old name)/Year when found	Taxon	Elements	Source: Lubicz-Niezabitowski
<i>Poland</i>				
1	Kraków, vicinity	E.a.	molar: upper M2	1912a
2	Oborniki; before 1903	E.a.	molars: upper M2 and lower M3	1912a, 1926
3	San river near Przemyśl; 1888	E.a.	molar: lower M1	1912a
4	Warszawa Szczęśliwice (Warszawa); before 1883, 1884	E.a.	3 M	1912a
5	Dunajec river near Tarnów	E.a./ <i>Mammuthus</i> sp.		1912a
6	Barycz near Przemyśl	M.p.	bones	1934
7	Dunajec river near Ludźmierz	M.p.	molar: upper M2	1912b
8	Góra Bronisławy, Kraków	M.p.	molar: upper deciduous M2	1912a, 1938c
9	Nowy Targ	M.p.	bones, one individual: cervical vertebra, thoracic vertebra, rib, carpal bone, calcaneus	1912b
10	Oborniki; before 1900	M.p.	bones	1926
11	Okiennik Cave near Ojców; before 1938	M.p.	molars: 2 lower deciduous M2 (presumably one individuals)	1938b, 1938c
12	Poznań Główna (Główna)	M.p.	bones	1926
	Poznań Szelągowska (Szeląg near Poznań); before 1926	M.p.	bones	1926, 1929c
13	Rogoźnik, Rogoźniczek stream; before 1852	M.p.	tooth	1912b
14	Zalesie near Jarocin; 1906	M.p.	bones	1926
15	Oborniki	M.t.?	lower deciduous M3	1912a
16	Wiśłok river	Mammoth	bones	1931
17	Mammutowa Cave near Ojców		bones	1932b
<i>Ukraine</i>				
1	Sąsiadowice near Sambor	E.a.	molar: lower M2?	1912a
2	Sławuta, Wotyń	E.t.	molar: M2	1912a
3	Starunia	M.p.		1911b, 1914

Dicrostonyx, *Cricetus*, *Mustela*, *Alopex*, *Talpa*, and *Rattus*.

Lubicz-Niezabitowski not only described the remains of mammals in terms of their morphology and osteometry, but also in their depositional context and with an interdisciplinary approach. An example of this is his work on the Szeląg site (Lubicz-Niezabitowski, 1929c), which is now called Poznań Szelągowska.

2.1. Elephantidae Gray, 1821

Elephantine remains (*Mammuthus primigenius*, *Elephas (Palaeoloxodon) antiquus*, *Mammuthus trogontherii*) were described by Lubicz-Niezabitowski (see Table 1 for detailed references) from 17 localities in Poland (Table 1). The bones from one (Nowy Targ)

represent elements of a single woolly mammoth individual. A further three represent sites in contemporary Ukraine. They come almost totally from fluvial contexts and were predominantly found in gravel pits.

2.2. Rhinocerotidae Gray, 1821

Among the remains of woolly rhinoceros (*Coelodonta antiquitatis*), which are known from 21 localities in Poland, fragments of skulls and isolated teeth are almost as well represented as bones (Table 2). Especially noteworthy are the well-preserved skulls from Poznań, described in 1926 along with other finds, in the monograph, “The remains of woolly rhinoceros (*Rhinoceros antiquitatis* Blum.) found in Wielkopolska region” (Lubicz-Niezabitowski, 1926) (Fig. 1).

Table 2

Remains of woolly rhinoceros (*Coelodonta antiquitatis*) from Lubicz-Niezabitowski's research.

	Localities (old name)/Year when found	Elements	Source: Lubicz-Niezabitowski
	<i>Poland</i>		
1	Czarnków; 1909	scapula	1926
2	Czerwonak (Poznań Czerwonak), Warta river; 1910	radius	1926
3	Gołaszyn near Oborniki	lower tooth	1926
4	Jankowo; 1909	tibia	1926
5	Karzec near Gostyń; 12/03/1889	pelvis, femur	1926
6	Kielce Kadzielnia (Grotta Kadzielnia)		1926
7	Kobylnica	skull fragment, upper tooth, lower tooth	1926
8	Kowanowo near Oborniki	mandible with tooth	1926
9	Kowanówko near Oborniki	lower teeth, metacarpal III	1926
10	Luboń near Poznań (Lubań near Poznań)	upper tooth	1926
	Luboń (Żabikowo)	mandible with tooth, lower tooth	1926
11	Mechowo near Swarzędz; 20/03/1890	skull fragment, mandible with teeth, lower teeth, metacarpal IV, pelvis	1926
12	Oborniki; before 1900; 1905; 1908; 1909; 1911; 1912; before 1926	skull fragment, upper teeth, mandible with teeth, lower teeth, thoracic vertebra, scapulae, humeri, radii, pelvis, femur, astragalus, metatarsus III	1926
13	Ostrzeszów	skull fragment	1926
14	Poland; 1910; 1912; 1918	upper teeth, scapulae, ulnae, tibiae, astragalus	1926
15	Poznań Dębiec (Dębiec near Poznań); 1905; 1907; 1909; 1911; 1919	skulls, scapula, humeri, metacarpal IV, pelvis	1926
	Poznań Główna (Główna)	bones	1926
	Poznań Malta; 25/10/1889	mandible with teeth, pelvis	1926
	Poznań Starołęka (vicinity of Starołęka)		1926
	Poznań Szelągowska (Szeląg near Poznań); 1913	radius, tibia, metatarsal III	1926, 1929c
	Poznań Wilczy Młyn (Wilczy Młyn-Poznań); 1906	pelvis	1926
	Poznań Wilda; 1897	skulls, upper tooth, humerus, radius	1926
	Poznań Zegrze (Zegrze near Poznań); 1909	lower tooth, pelvis	1926
	Poznań, vicinity	skull fragment	1926
16	Prosna river	mandible with teeth, rib	1926
17	Śrem; 1907	atlas	1926
18	Wielkopolska	ulna	1926
19	Wierzenica near Mechowo	radius	1926
20	Zalesie near Jarocin; 1906; 1910	lower tooth, scapula, pelvis	1926
21	Okiennik Cave near Ojców; before 1938	bones	1938c
	<i>Ukraine</i>		
1	Biała Cerkiew (Złoty Potok); before 1853	skull	1913a, 1926
2	Starunia; 1929	skeleton and skin	1911a, 1914

The specimen from Starunia (Ukraine) is the best known, due to its completeness, as it is preserved along with the skin and entrails (Lubicz-Niezabitowski, 1911a, 1914). The context of these finds was extensively studied in terms of a broad range of aspects, from topography and the geological setting of the site to analyses of molluscs, insects, plants, and fossil remains of other vertebrates (amphibians, birds, and mammals with detailed analysis of the woolly mammoth) (Bayger et al., 1914). Recently, more studies were carried out at Starunia, focusing on geochemical and geoelectrical

studies investigating the geological setting and environment of the Pleistocene sediments (Kotarba et al., 2008), as well as geochemical studies of biomarker distribution and stable carbon isotopes of bitumen (Kotarba et al., 2009), lithological studies (Sokołowski et al., 2009), and radiocarbon dating of Pleistocene fauna and flora (Kuc et al., 2012). With regard to the latter, radiocarbon dating gave the remains of the woolly rhinoceros an age of 36.7 ± 0.6 ka BP (specimen No. 3) and a range from 35.3 to 40.0 ka BP (specimen No. 2) (Kuc et al., 2012).

The second find from Ukraine was initially described as being from a Polish site, Złoty Potok (Lubicz-Niezabitowski, 1913a), and was later revised to Bila Tserkva (Biała Cerkiew) in Ukraine (Lubicz-Niezabitowski, 1926). He also dealt with a study of *Teleoceras ponticus* (sic.) remains from Odessa (Ukraine) (Lubicz-Niezabitowski, 1913b).

2.3. Cervidae Goldfuss, 1820

Among the Cervidae identified by Lubicz-Niezabitowski, he paid particular attention to species such as giant deer (*Megaloceros giganteus*), Eurasian elk (*Alces alces*), red deer (*Cervus elaphus*) and reindeer (*Rangifer tarandus*) (Tables 3–6).

The skull from Barycz with a deformity in one antler is an especially important find among the remains of giant deer (*Megaloceros giganteus*) (Lubicz-Niezabitowski, 1934, 1935; Table 3). More

Table 3Remains of giant deer (*Megaloceros giganteus*) from Lubicz-Niezabitowski's research.

	Localities (old name)	Elements	Source: Lubicz-Niezabitowski
	<i>Poland</i>		
1	Barycz near San river; 1934/1935	skull and antlers	1934,1935
2	Białystok Dojlidy (Doilidy near Białystok); before 1899	antler	1934, 1935
3	Gnatowice; before 1882	antler	1934, 1935
4	Ludwinów near Kraków; before 1911	skull and antlers	1934, 1935
5	Małopolska; before 1912	6 fragments of skulls and antlers	1934, 1935
6	Mastów na Śląsku; before 1731		1934, 1935
7	Oborniki; before 1900	bones	1926
8	Prosna river near Robaków; before 1896	antler	1934, 1935
9	Wielkopolska; before 1913		1934, 1935
	<i>Ukraine</i>		
1	Turza river near Włodzimierz Wołyński; 1887	antler	1935

Table 4Remains of Eurasian elk (*Alces alces*) from Lubicz-Niezabitowski's research.

	Localities (old name)/Year when found	Elements	Source: Lubicz-Niezabitowski
	<i>Poland</i>		
1	Bednary near Pobiedziska	antler	1929b
2	Dunajec river	antlers	1912b
3	Gościeszyn near Obra river	antler fragment	1929b
4	Jaszczurówka near Zakopane; 1889	skeleton, female	1929b, 1932c
5	Kotowiecko	antler fragment	1929b
6	Krzeńlice near Pobiedziska; 1861	almost complete skeleton	1929b, 1932c
7	Lubosz	antler fragment	1929b
8	Łabiszyn near Noteć river	antler	1929b
9	Łukaszewko near Trzemeszno; 1928	almost complete skeleton	1929b, 1932c
10	Mitosał	antler fragment	1929b
11	Niż Polski		1932c
12	Połajewo near Oborniki	antler fragment	1929b
13	Poznań Główna (Główna near Poznań); 1928	skeleton	1929b
14	Prosna river	antler fragment	1929b
15	Rogówek	antler fragments	1929b
16	Środa	antler fragment	1929b
17	Warta river near Oborniki	skull and antler fragments	1929b
18	Wielkopolska	3 skulls	1929b
19	Wielowieś	antler fragments	1929b
20	Wisłok river	bones	1931
21	Żabikowo	skull	1929b
	<i>Ukraine</i>		
1	Strwiąż river near Felsztyn	antlers	1932c
2	Strwiąż river near Gęboka		1929b

Table 5Remains of red deer (*Cervus elaphus*) from Lubicz-Niezabitowski's research.

	Localities (old name)/Year when found	Elements	Source: Lubicz-Niezabitowski
	<i>Poland</i>		
1	Poznań Główna (Główna)	bones	1926
	Poznań Szelągowska (Szeląg near Poznań); before 1929	bones	1926, 1929c
2	Wisłok river	bones	1931

Table 6Remains of reindeer (*Rangifer tarandus*) from Lubicz-Niezabitowski's research.

	Localities (old name)/Year when found	Elements	Source: Lubicz-Niezabitowski
	<i>Poland</i>		
1	Czutów, Murek Cave		1914
2	Gądki		1914
3	Gniezno		1914
4	Maszyce, Maszycka Cave		1914
5	Mników, Jaskinia na Miłaszówce		1914
6	Murowana Goślina		1914
7	Nowy Sącz		1914
8	Oborniki		1914
9	Okienik Cave near Ojców; before 1938	bones	1938d
10	Piekary, Jaskinia na Gołąbcu		1914
11	Poznań Naramowicka (Naramowice)		1914
12	Tuczępy		1914
13	Wierzchowie, Mammutowa Cave		1914
14	Wisłoka river near Dębica	skull	1914; 1931
15	Zalesie near Jarocin; 1906	bones	1914; 1926

recently, a revision of the skull (IG-UAM/Br/12F1) was carried out using modern methods, such as gross morphology, radiography, computed tomography, and histopathology (Pawłowska et al., 2014; Fig. 2). As a result of this, the antler deformity appears to be of traumatic origin with a healing component. Its date ($39,800 \pm 1000$ BP) corresponds to MIS-3, when giant deer were widespread in Europe (Pawłowska et al., 2014). The skull from Barycz represents a rather large form of giant deer, since its measurements, and especially its frontal breadth, corresponds to larger specimens from the Irish sample (Croitor et al., 2014).

The remains of elk have been described from peatlands, as well as from lake and river sediments. Complete skeletons have been found relatively infrequently—only four cases are known—and most frequently these are fragments of antlers, skulls, and bones (Fig. 3; Table 4). Radiocarbon dating of one of the skulls (IG-UAM/Ż/14F1; Fig. 4) from the Żabikowo site, preserved to this day in the collection, gave the results of 9450 ± 50 BP (Poz-53724; Poznań

Radiocarbon Laboratory). Two of Lubicz-Niezabitowski's writings are wholly dedicated to his work on Eurasian elk remains (*Alces alces*) (Lubicz-Niezabitowski, 1929b, 1932c), and this taxon is also dealt with in other writings.

Describing the spatial range of the occurrence of the elk and the distribution of its remains in Poland, Lubicz-Niezabitowski also paid attention to the process of decomposition of the carcasses of the animals and the conditions that affected the state of preservation of the remains—such as permafrost, salt, bitumen (oil) and anaerobic conditions (Lubicz-Niezabitowski, 1932c).

2.4. Bovidae Gray, 1821

The family Bovidae is represented by finds of European bison (*Bison bonasus*), steppe wisent (*Bison priscus*), aurochs (*Bos primigenius*), cattle (*Bos primigenius taurus*), muskox (*Ovibos moschatus*), and saiga (*Saiga tatarica*) (Tables 7–10).

Table 7
Remains of European bison (*Bison bonasus*) from Lubicz-Niezabitowski's research.

	Localities (old name)/Year when found	Elements	Source: Lubicz-Niezabitowski
	<i>Poland</i>		
1	Brodnica	skull	1931
2	Czudec, Wisłok river; 1925 and before 1931	2 skulls, male	1931
3	Galinowo; before 1909	skull	1931
4	Goręczyn	skull	1931
5	Grabów	skeleton, male (and human skeleton)	1931
6	Iwno near Poznań	skull fragment and horn cores	1938d; 1938e
7	Małopolska	skull, male; horn core, male	1931
8	Osieczek	skull	1931
9	Rzeszów, Wisłok river	skull, female	1931
10	Starkowiec Piątkowski near Miłostaw (Starkowiec Piątkowski near Miłostaw)	presumably complete skeleton, male	1938d; 1938e
11	Winna Góra (Winnagóra); 06/1937	complete skeleton	1938d
	<i>Ukraine</i>		
1	Maikowice	horn core, female	1931
2	Grodno	skull, female	

Table 8
Remains of steppe wisent (*Bison priscus*) from Lubicz-Niezabitowski's research.

	Localities (old name)/Year when found	Elements	Source: Lubicz-Niezabitowski
	<i>Poland</i>		
1	Chełmno, Wisła river; before 1909	skull	1948a
2	Gryżyna; 25/06/1937	skull	1948a
3	Oborniki; before 1900	bones	1926
4	Okiennik Cave near Ojców; before 1938	bones	1938c
5	Poznań	skull	1948a
	Poznań Szelągowska (Szeląg near Poznań); before 1929	bones	1929c
6	Tczew; before 1948	skull	1948a
7	Zalesie near Jarocin; 1906	bones	1926

Table 9
Remains of aurochs and cattle from Lubicz-Niezabitowski's research. The original nomenclature has been preserved.

	Localities (old name)/Year when found	Taxon	Elements	Source: Lubicz-Niezabitowski
	<i>Poland</i>			
1	Krzeszowice near Kraków	<i>Bos brachyceros</i>		1924c
2	Pomorze		5 skulls	1948b
3	Poznań Główna (Główna)	<i>Bos</i> sp.	bones	1926
	Poznań Szelągowska (Szeląg near Poznań); before 1929	<i>Bos primigenius</i>	bones	1929c
	Poznań Szelągowska (Szeląg)	<i>Bos</i> sp.	bones	1926
4	Prosna river near Wieruszowa; 1939	<i>Bos primigenius taurus</i>	skull, male	1948b
5	Wisłok river	<i>Bos primigenius taurus</i>	bones	1931

Table 10

Remains of muskox (*Ovibos moschatus*) and saiga (*Saiga tatarica*) from Lubicz-Niezabitowski's research.

Localities (old name)	Elements	Source: Lubicz-Niezabitowski
<i>Ovibos moschatus</i>		
Poland		
1 Kraków, vicinity		1924c
2 Pomorze		1924c
3 Świecie (Przechowo)	skull	1924c
Ukraine		
1 Wołyń		1924c
<i>Saiga tatarica</i>		
Poland		
1 Chelmno, vicinity (Osnowo)		1924c

A total of 13 localities yielding European bison remains are mentioned by Lubicz-Niezabitowski (Table 7). An overview of the 8 finds of European bison in Poland, in the context of the 10 bison finds in Europe of the time, he gave in his work entitled "The fossil remains of bison (*Bison bonasus* L.) in Polish lands" (Lubicz-Niezabitowski, 1931). It contains a summary and comparison mostly of skulls. Attention is there paid to the discovery of a bison skeleton and a human skeleton, found together at a depth of 4–6 m

in peat in Grabów, in the northern part of Poland. Along with these two skeletons was found an artifact—a gneiss axe, according to Lubicz-Niezabitowski. Unfortunately, the skeletons were destroyed in the exploration stage, and only the bison skull and axe were published (Lubicz-Niezabitowski, 1931). In turn, Lubicz-Niezabitowski described skulls from another site (Czudec) in the depositional context, giving a lithological profile and the results of paleobotanical and malacological analyses. Two subsequent bison skeletons from Starkowiec Piątkowski and Winna Góra have been found in peat.

In contrast, the remains of the steppe wisents and aurochs—mainly skulls and isolated bones—come from the fluvial depositional context, namely sands and gravels (Tables 8 and 9). Only a few localities provided the remains of muskox and saiga, and little is known about these finds (Table 10).

2.5. Equidae Gray, 1821

Horse remains, including isolated bones, teeth, and a skull, are listed for 5 localities in different parts of Poland, and in one case in Ukraine (Lubicz-Niezabitowski, 1912b, 1926, 1929c, 1938b; Adametz et al., 1914) (Table 11).

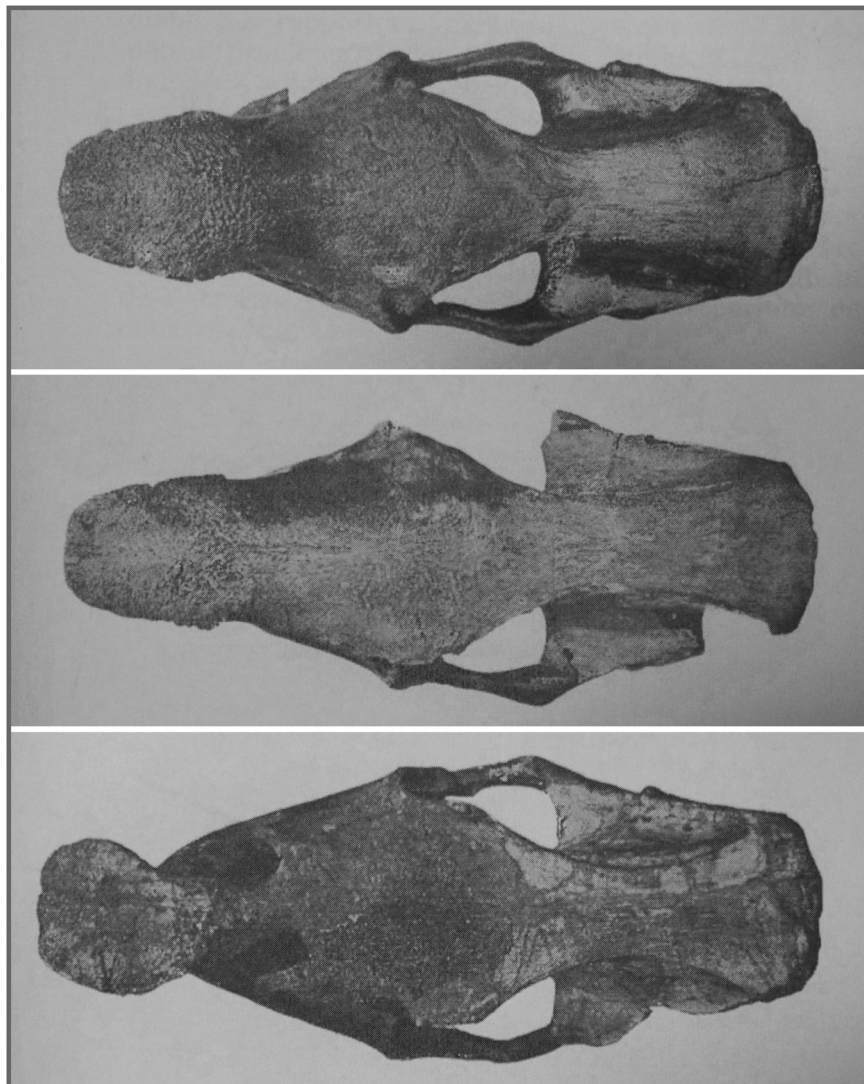


Fig. 1. Poland, Poznań site. Well-preserved skulls of woolly rhinoceros (*Coelodonta antiquitatis*). Source: Lubicz-Niezabitowski (1926).

Table 11Remains of horse from Lubicz-Niezabitowski's research. Abbreviations: E.c. – *Equus caballus*, E.sp. – *Equus* sp. The original nomenclature has been preserved.

	Localities (old name)/Year when found	Taxon	Elements	Source: Lubicz-Niezabitowski
	<i>Poland</i>			
1	Dunajec river		teeth	1912b
2	Oborniki; before 1900	E.c.	bones	1926
3	Okiennik Cave near Ojców; before 1938	E.sp.	bones	1938c
4	Poznań Główna (Główna)	E.c.	bones	1926
	Poznań Szeląg (Szeląg)	E.c.	bones	1926
	Poznań Szelągowska (Szeląg near Poznań); before 1929	E. sp.	bones	1929c
5	Zalesie near Jarocin; 1906	E.c.	bones	1926
	<i>Ukraine</i>			
1	Złoczów	E.sp.	skull	Adametz et al., 1914

2.6. Carnivora Bowdich, 1821

Among Carnivora, representatives of the Ursidae (G. Fischer de Waldheim, 1817), Canidae (G. Fischer, 1817), and Felidae (G. Fischer, 1817) families were described by Lubicz-Niezabitowski. These include finds of cave bear (*Ursus spelaeus*) (Lubicz-Niezabitowski, 1899, 1924b), wolf (*Canis lupus*) (Lubicz-Niezabitowski, 1938b, 1938c), arctic fox (*Alopex lagopus*), and cave lion (*Panthera leo spelaea*) (Lubicz-Niezabitowski, 1925, 1938b, 1938c) (Table 12).

3. Concluding remarks

The Legacy of Edward Feliks Lubicz-Niezabitowski (1875–1946) has both methodological and scientific significance.

Lubicz-Niezabitowski's work provided knowledge of morphological and morphometric issues. Reading his morphological descriptions of remains, one is struck with how easy it is to visualize the specimens. The measurements of the specimens are described in excellent detail. In fact, rewriting the descriptions into today's

Table 12Remains of Carnivore (cave bear, *Ursus spelaeus*; wolf, *Canis lupus*; arctic fox, *Alopex lagopus*; cave lion, *Panthera leo spelaea*) from Lubicz-Niezabitowski's research.

	Localities (old name)/Year when found	Elements	Source: Lubicz-Niezabitowski
	<i>Ursus spelaeus</i>		
	<i>Poland</i>		
1	Dunajec river	teeth	1912b
2	Jaskinia Magurska, Tatra Mts. (Grota Magura, Tatra Mts.); before 1938	bones	1938c
3	Jaskinia Wierchowska Górna	mandible with teeth	1899
4	Mammutowa Cave near Ojców	bones	1932b
	<i>Canis lupus</i>		
	<i>Poland</i>		
1	Jaskinia Magurska, Tatra Mts. (Grota Magura, Tatra Mts.); before 1938	mandible with teeth, female	1938b, 1938c
2	Okiennik Cave near Ojców; before 1938	bones	1938c
	<i>Alopex lagopus</i>		
	<i>Poland</i>		
1	Mammutowa Cave near Ojców; 1932		
	<i>Panthera leo spelaea</i>		
	<i>Poland</i>		
1	Bębio, Jaskinia Bębłowska Dola		1925
2	Jaskinia Magurska, Tatra Mts. (Grota Magura, Tatra Mts.); before 1925	2 bones	1925; 1938b; 1938c
3	Kowanówek near Obornik	mandible with teeth	1938b; 1938c
4	Milowice		1938c
5	Ojców groty, vicinity; before 1925		1925; 1938b; 1938c
6	Wierchowie, Jaskinia Wierchowska Górna		1925
	<i>Ukraine</i>		
1	Wołyń; before 1925		1925; 1938b; 1938c
2	Rudki	maxilla with teeth	1938b; 1938c
	<i>Germany</i>		
1	Oderberg-Bralitz' near Frankfurt		1938b; 1938c
2	Lindenthal near Lipsk; 1907	mandible with teeth	1938b; 1938c

Most of the localities (of which there are 10 in total) are associated with cave lion finds, and are located in the present-day territories of Poland, Ukraine, and Germany. The most important of these locations is Kowanówek near Oborniki, where the mandible of a cave lion was found; its significance is due to the fact that it is the northernmost site with cave lion remains in Poland (Lubicz-Niezabitowski, 1938b).

2.7. Rodentia Bowdich, 1821

Little is known about potential Rodentia finds, and only the vicinity of Poznań has been pointed out as the location of a find of the remains of the European beaver (Lubicz-Niezabitowski, 1929c).

standards would present no problem. The locations of the finds, where known, are so precisely described that today, over a century later, they can be easily found on a map.

Despite the fact that Lubicz-Niezabitowski worked mostly on mammals finds from Polish sites, and especially from one region, he also undertook the analysis of finds fossil remains from present-day Ukraine. Some specimens have been presented in their cultural context. His published results, summarized in this paper, are an invaluable source of information about the diversity and occurrence of Pleistocene mammals in Poland. They make a major contribution to the existing dataset in this regards. Thus, their wider use in synthetic works is indicated.



Fig. 2. Poland, Barycz site. Giant deer (*Megaloceros giganteus*) skull in frontal view with a deformity of one antler (Lubicz-Niezabitowski, 1934, 1935; Pawłowska et al., 2014; IG-UAM/Br/12F1). Photo: K. Pawłowska.

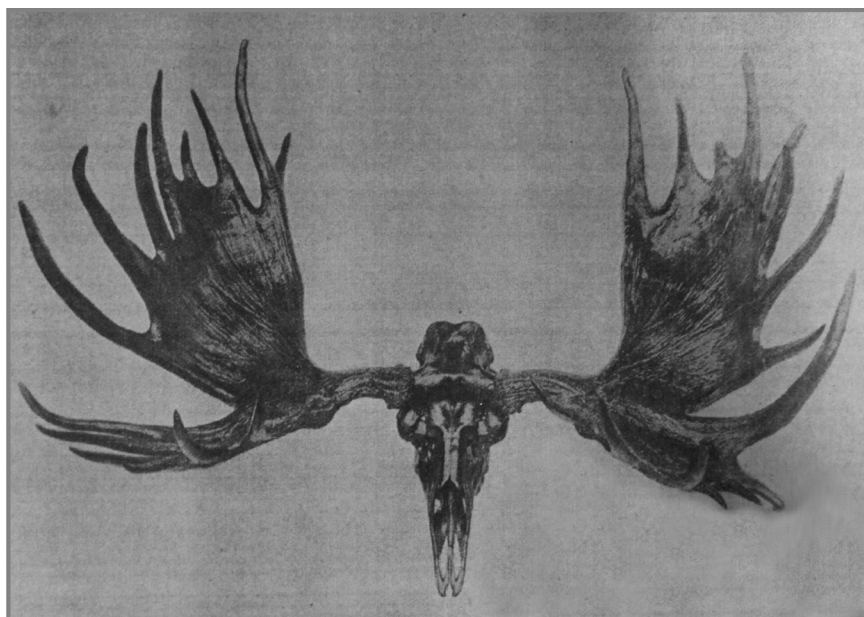


Fig. 3. Poland, Łukaszewko site. Skull of Eurasian elk (*Alces alces*) with antlers, found as part of an almost complete skeleton. The antlers' span reached 162 cm. Source: Lubicz-Niezabitowski (1929b, 1932c).



Fig. 4. Poland, Żabikowo site. Skull of Eurasian elk (*Alces alces*) in frontal view (IG-UAM/Ż/14F1). Photo: K. Pawłowska.

It is worth quoting Lubicz-Niezabitowski on the care of specimens using the methods of the time: “Excavated specimens should be carefully wrapped in yarn or paper and tied with string. The place of the find should be detailed on an attached piece of paper, along with information on the quality of the soil in which the item was found. The wrapped item should be covered in hay, straw, or shavings and sent in a package to the Museum.” (Lubicz-Niezabitowski, 1933b).

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