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THE STORY OF ONE WOMAN – NEW BIOARCHAEOLOGICAL DATA ON THE INTERPRETATION OF A ROMAN IRON AGE GRAVE IN A LOG COFFIN FROM BAGICZ (WOJ. ZACHODNIOPOMORSKIE / PL)

The Wielbark Culture is one of the most interesting cultural phenomena in Poland during the Roman Iron Age (1st-4th century AD). This is mostly due to their origin, which is associated in Polish literature with the arrival of the Goths from Scandinavia. They created diverse funeral rites as well as a taboo for weapons or any items made of iron among the grave goods (Wołągiewicz 1981, 152; Kmieciński 1962, 88-92; Walenta 1980/1981). The most interesting aspect of this phenomenon is the practice of both inhumation and cremation in equal measure.

The grave of the woman from Bagicz (German: Bodenhagen; woj. zachodniopomorskie / PL; see **fig. 1**) was discovered in 1899 when the log coffin fell from a seashore cliff and was later described by H. Schumann (1900). The individual was deposited in a log coffin, equipped with a brooch, two bronze bracelets, a necklace,

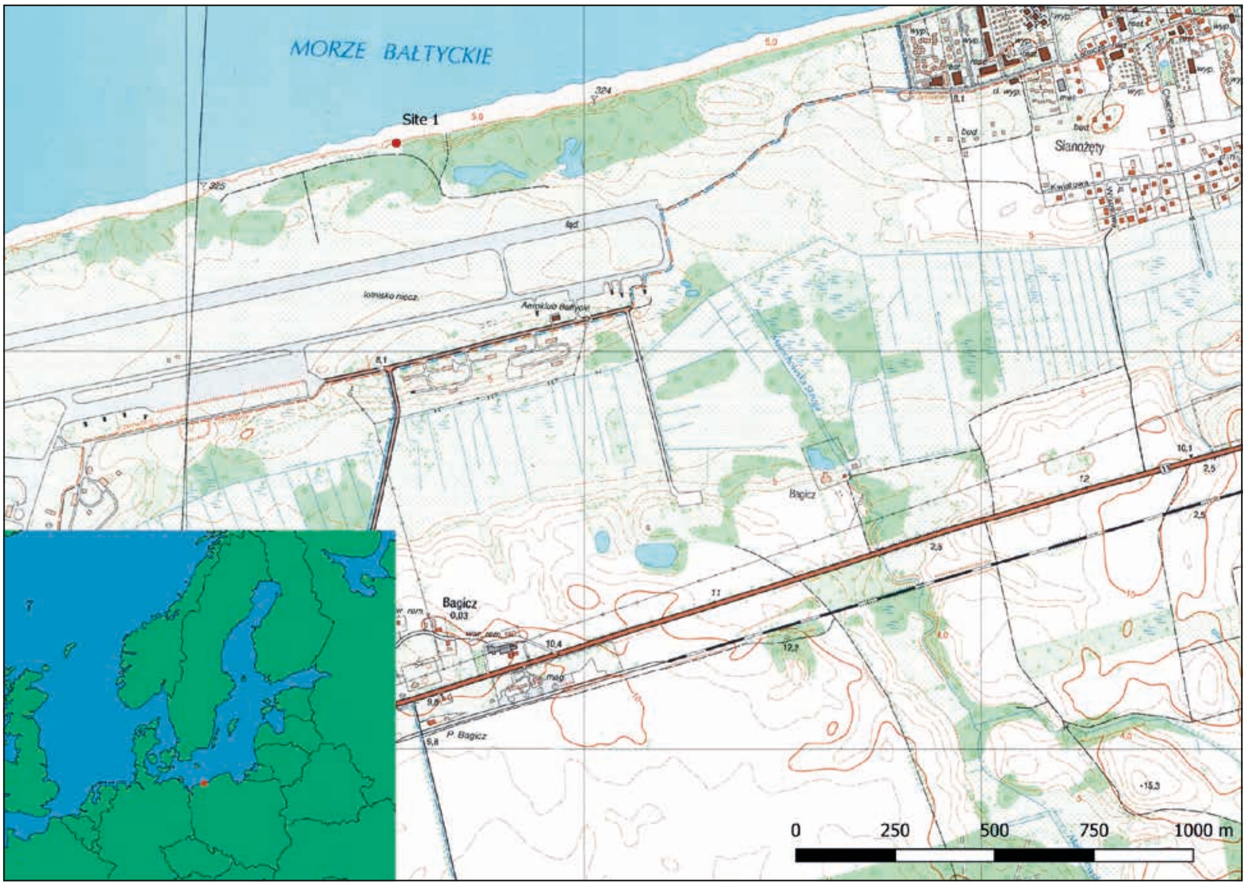

Fig. 1 The location of Bagicz (woj. zachodniopomorskie / PL). – (Map M. Chmiel-Chrzanowska).

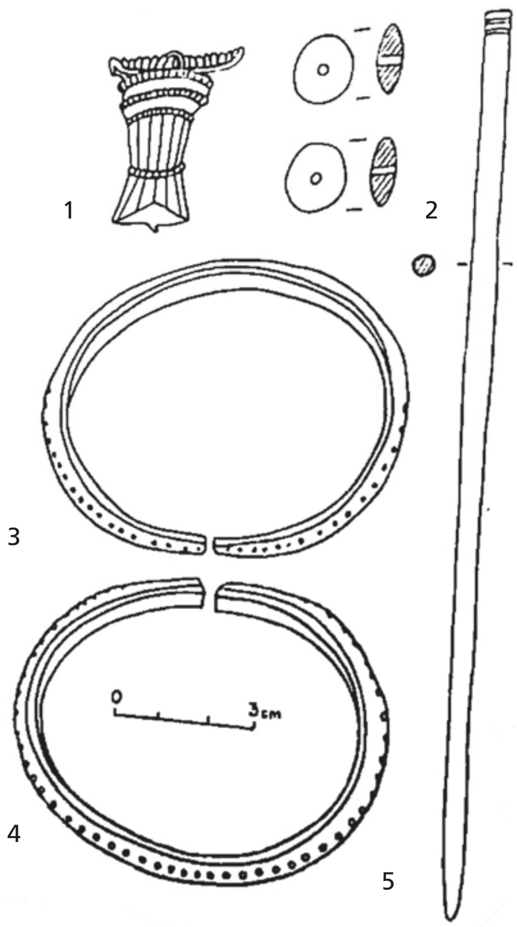

Fig. 2 Artefacts from the grave of the woman from Bagicz: **1** bronze brooch. – **2** two amber beads. – **3-4** bronze bracelets. – **5** bone pin. – (After Wołągiewicz 1981, 42 fig. 3, 3).

and a bone pin (fig. 2). Impressively, the organic materials that have been found are extremely well preserved; they included a wooden stool, a bovine pelt, and fragments of woolen clothes. Possibly, these artefacts were well preserved due to the deposition in a humid environment.

Since its discovery, the grave was mentioned only a few times in German archaeological literature when citing the finds from Bagicz. The grave became famous in Polish archaeology due to its well-preserved artefacts and human remains (e.g. Dibblet 1936; Wołągiewicz 1980). Now modern science gives us new tools to rewrite and examine the biography of this individual from Bagicz.

The main aim of this paper is to answer questions about the social position of this individual by taking a closer look at the context found in the grave and the controversies, which surround the burial for years. This objective will be completed by using a bioarchaeological toolkit (radiocarbon dating, carbon and nitrogen stable isotope analysis, carbon and oxygen stable isotope analysis, strontium analysis) and analysing the cultural and environmental background.

HISTORY OF RESEARCH, CULTURAL AND ENVIRONMENTAL CONTEXT

The archaeological study organised by H. Schumann was accompanied by an anthropological examination of the bones. He described the skeleton as belonging to a mature woman of very short stature (1.38 m) which borders a dwarf size. He also pointed out a brachycephaly. In his opinion, there were no palaeopathological changes on the bones. Yet it should also be mentioned that a part of the skeleton had been missing during the exploration (Schumann 1900; Parafiniuk/Wdowiak 1980, 57).

Several decades later the grave was reexamined by M. Prafiniuk and J. Wdowiak (1980) who conducted an anthropological analysis. They determined the stature of the deceased at 145 cm, defined the age as adult, and confirmed the sex as female (Parafiniuk/Wdowiak 1980). R. Wołągiewcz undertook the cultural interpretation and the definition of chronology. His theories about this individual had been circulated mostly around the possibilities of explaining the reasons why the deceased was buried in a single grave on the cliff and her social status. In scientific discourse, she is described as a princess due to this practice not being typical for representatives of the Wielbark Culture; however, some examples of this kind of customs are known (Walenta 2007).

R. Wołągiewicz had two main hypotheses about this individual. According to the first one, the grave was related to another known Wielbarkian cemetery that came to light at the Bagicz airbase during its construction in 1935, pointed as site 2. The excavation, organised by O. Dibbelt, led to the discovery of four graves. The chronology of the finds from these graves and the log coffin grave from the cliff was the same (Wołągiewicz 1980, 46). In Wołągiewicz's opinion, the single grave may be part of a larger cemetery

Fig. 3 Modern view of the cliff in Bagicz, where the log coffin grave was found. – (After Chmiel-Chrzanowska 2018b, fig. 5).

complex known from the 1930s. The situation may be analogous to the cemetery complex dug by him in Gronowo (woj. warmińsko-mazurskie / PL). This hypothesis would relate to burials of a privileged part of the community, such as the cemetery complex in Gronowo, where next to the barrow cemetery a flat cemetery was located (cf. Machajewski 2013). According to this, the individual from Bagicz was buried alone because of her higher social status.

R. Wołągiewicz did not exclude his second hypothesis which theorises that the single grave resulted from a strong abrasion in this seashore section, so the partial destruction of a single large cemetery was considered (Wołągiewicz 1980, 39-44).

The site and its neighbourhood are highly exposed to various coastal processes, e. g. abrasion as the most significant one (**fig. 3**). This is due to the local geology and cliff structure (see Musielak / Furmańczyk / Bugajczyk 2017). The average abrasion rate in this area is c. 0.7 m per year. Additionally, weather is crucial for the state of erosion. During 2018, new Wielbarkian cremation graves were discovered at the same place where the log coffin grave was found in 1899 due to the effects of an early thawing in the spring, a hot summer, and an extraordinary intense autumn storm season. Only one of them was excavated because of progressive abrasion (Chmiel-Chrzanowska 2018a; 2018b). If we take into account that the abrasion during a 120-year period oscillates between 0.7 or even 1 m, the log coffin grave was found approx. 120 m from the modern sea, the shoreline, and the cremation grave.

Additionally, in 2016 some 1.5 km from the modern seashore line of the Baltic Sea, a new Wielbarkian barrow site was discovered using LIDAR technology, on which 57 barrows of varying diameter had been observed. The excavations of two mounds (Chmiel-Chrzanowska 2018a) confirmed the chronology and cultural affinity of the site. That kind of cemeteries is connected with the Goths, which according to ancient written sources, arrived at modern-day Polish territory from Scandinavia. The chronology of this type of cemeteries in Poland makes them simultaneous with the cemetery from the airbase and the grave from Bagicz.

ISOTOPIC RECONSTRUCTION OF THE DIET AND MIGRATION

Current bioarchaeological methods allow for more detailed insight into the life of past populations (Koch 2007; Lee-Thorp 2008). Standard biochemical analysis of tooth tissues, collagen and bioapatite, can provide informations about an individual's diet and provenance.

Diet can be reconstructed by the analysis of the carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope ratio. Carbon isotopes allow for the differentiation between diets based on marine and/or terrestrial resources because those two ecosystems systematically differ in $\delta^{13}C$ values of the source of carbon (Chisholm/Nelson/Schwarcz 1982). In terrestrial ecosystems, differences in $\delta^{13}C$ values are observed between plants utilising different photosynthetic pathways: C_3 plants with values lower than -22‰ (O'Leary 1988; Farquhar/Ehleringer/Hubick 1989) and C_4 plants with the average value of -12.6 ± 1.5‰ calculated based on Pyankov et al. (2010). In Central Europe, C_3 plants are more abundant and only millet (C_4 plant) was cultivated in the region in the 1st millennium AD, hence it is possible to indicate the presence of millet in the diet.

Plants express $\delta^{15}N$ values similar to those observed in soil (Evans 2001). The $\delta^{15}N$ values of soil are similar within the climate zone (Amundson et al. 2003), but can be locally altered by, for example, manuring (Bogaard et al. 2007).

Consumers are enriched in heavier carbon and nitrogen isotopes relative to the diet. The value of this trophic enrichment depends on the type of tissue. The trophic enrichment of collagen is 3.7 ± 1.6‰ for $\delta^{13}C$ values and 3.6 ± 1.3‰ for $\delta^{15}N$ values (cf. review in Szpak et al. 2012), of bioapatite: 10.2 ± 1.3‰ for $\delta^{13}C$ values (Howland et al. 2003). In more complex food chains, where a predator consumes another predator, observed stable isotope values are elevated (Schoeninger/DeNiro 1984). However, in mixed marine/terrestrial or C_3/C_4 diet, the isotopic differences of the food items can efface the effect of trophic enrichment.

The consumption of aquatic resources can also affect the proportion of ^{14}C isotopes in the consumer. Significant consumption of fish can result in radiocarbon dates being even a few hundred years older. This is the well-known reservoir effect, present when carbon originates from a system without constant exchange with an atmosphere where ^{14}C is produced (Philippsen 2013).

The provenance can be reconstructed based on the oxygen ($\delta^{18}O$) and strontium ($^{87}Sr/^{86}Sr$) isotope ratio (Bentley 2006; Price/Burton/Bentley 2002; Pederzani/Britton 2019). Both systems express the geographical variation and comparison between the local environment and human individual, which can indicate if the individual is of local or non-local origin. Further investigations are more difficult because many regions can express similar values.

The proportion of strontium isotopes in the environment depends on the composition and age of the bedrock (Bentley 2006). Water releases strontium from the rocks and transports it, e.g. via rivers. Usually, alluvium along the river expresses a strontium ratio different from one observed further from the riverbed (Bentley 2006). Plants uptake and fix strontium into their tissues because of the similarity between strontium and calcium (Åberg et al. 1990). For the same reason, animals fix strontium originating from their food into bone apatite. Strontium does not undergo trophic enrichment and the values remain similar between diet and consumer (e.g. Blum et al. 2000).

The distribution of $\delta^{18}O$ values in precipitation depends on the distance from the main moisture reservoir, for Poland this being the Atlantic Ocean, altitude, and season, among others. Meteoric precipitation refills the surface water; hence $\delta^{18}O$ values of rivers, lakes, and groundwater are related to the values of the rain (Pederzani/Britton 2019). Water, in the form of drink and food, is the most important source of oxygen in the body, other being atmospheric oxygen and structural oxygen in solid foods (Podlesak et al. 2008; Cernusak et al. 2016). The variety of sources and different techniques of food preparation (Brettell/Montgomery/Evans 2012) effects a variation of $\delta^{18}O$ in human individuals. The observed variation in

$\delta^{18}O$ values of the stationary human population can be greater than 3‰ (Lightfoot/O'Connell 2016). Nonetheless, oxygen stable isotope analysis is a useful technique to study human provenance.
The provenance study is based on the isotopic relation between meteoric water and body oxygen. Individuals of local origin should express $\delta^{18}O$ values similar to those of precipitation in that region, with species-specific offset. The $\delta^{18}O$ can be measured in two compounds present in biological apatite. Both stay in isotopic equilibrium with blood, but despite that, an offset of c. 8‰ between them can be observed (Pederzani/Britton 2019). Due to these differences, further discussion will be limited to carbonate present in enamel, as this substance was analysed in the present study.
The stable isotope ratio of oxygen in carbonate is highly correlated with drinking water. The formula proposed by Chenery et al. (2012) allows for the estimation of average $\delta^{18}O$ of the consumed water. This value can be further compared with environmental data – a local range.

MATERIAL AND METHODS

Bones belonging to the individual are deposited in the National Museum in Szczecin even before the analysis of M. Parafiniuk and J. Wdowiak (1980). Storage conditions were similar to other artefacts deposited in the museum. Between 1980 and 2011 they were part of an exhibition at the National Museum in Szczecin, afterwards, they were placed, once again, in storage rooms where they spent seven years. In 2018, the log coffin and human remains became part of the exhibition in the Museum of Polish Arms in Kołobrzeg. Effects of bone conservation were visible on the long bones and even the skull appeared to be intact.
Human remains were analysed following the recommendations of M. Brickley and J. McKinley (2004). Age was estimated following teeth attrition (Brothwell 1981), suture closure was omitted as an age estimator due to low performance (cf. Key/Aiello/Molleson 1994; Wolff/Hadadi/Vas 2013). Sex was determined following the skull morphology (Buikstra/Ubelaker 1994) and dimensions of long bones (Olivier 1960). Stature was estimated based on the method proposed by K. Pearson (1899). Biomolecular studies were conducted on the third permanent molar, due to better preservation (lesser attrition). The enamel of the third molar is created between 10 and 13 years of life, while rooting between 13 and 18.
Enamel was analysed for the strontium ($^{87}Sr/^{86}Sr$), carbon ($\delta^{13}C$), and oxygen ($\delta^{18}O$, in carbonate fraction) isotope ratio. Dentine was analysed for the carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope ratio and radiocarbon dated.
The strontium isotope ratio was measured in the Isotope Laboratory of the Adam Mickiewicz University at Poznań (Poland). The enamel was mechanically isolated and cleaned in an ultrasonic bath in ultrapure water to remove extraneous particles. Afterwards, following the procedure of Dufour et al. (2007), c. 10 mg of powdered enamel were treated sequentially (five times) with 0.1 mol ultrapure acetic acid to eliminate Sr contamination. Next, the sample was dissolved for a night on a hot plate (c. 100 °C) in closed PFA vials using 1N HNO_3. The separation of Sr was achieved with the chromatographic technique described by Pin et al. (1994) with modifications (Dopieralska 2003, 111). Strontium was loaded with a TaCl5 activator on a single Re filament and analysed in dynamic collection mode on a Finnigan MAT 261 mass spectrometer. The strontium isotopic ratio was measured against NBS 987 standard material. The $^{87}Sr/^{86}Sr$ values were corrected to $^{86}Sr/^{88}Sr$ = 0.1194. The Sr results for samples were normalized to NIST-987 = 0.710240.
Powdered enamel was also measured for the carbon and oxygen stable isotope ratio in enamel carbonate in the Stable Isotope Laboratory at Centre for Arctic Gas Hydrate, Environment and Climate at The Arctic University of Norway, Tromsø (Norway). The sample was placed in 4.5 mL vials and flushed with He, and five drops of water free H_3PO_4 were added manually with a syringe. After equilibration >3 h at T = 50 °C, the samples

were analysed on Gasbench II and MAT253 IRMS. Measurements were normalized to VPDB by three in-house standards (Isolab A: $\delta^{13}C_{VPDB}$ = 1.96 ± 0.05 ‰, $\delta^{18}O_{VPDB}$ = -2.15 ± 0.05 ‰; Isolab B: $\delta^{13}C_{VPDB}$ = -10.21 ± 0.05 ‰, $\delta^{18}O_{VPDB}$ = -18.59 ± 0.04 ‰; Merck $CaCO_3$: $\delta^{13}C_{VPDB}$ = -48.95 ‰, $\delta^{18}O_{VPDB}$ = -13.98 ‰), that were normalised to international standards: NBS18, NBS19, LSVEC. Carbon and oxygen stable isotopes were calculated in retaliation to Vienna PeeDee Belemite standard and expressed in per mill (‰). The $\delta^{18}O_{VPDB}$ was recalculated into $\delta^{18}O_{VSMOW}$ standard following formula of Coplen et al. (1983): $\delta^{18}O_{VSMOW} = \delta^{18}O_{VPDB} * 1.03091 + 30.91$. To obtain information about average values of consumed water, the $\delta^{18}O_{VSMOW}$ was next calculated following the formula proposed by Chenery et al. (2012): $\delta^{18}O_{DW} = \delta^{18}O_{VSMOW} * 1.59 - 48.634$.

The sample of dentine was radiocarbon dated in the Radiocarbon Laboratory in Poznań. Here, bone collagen was extracted using a modified Longin method (Longin 1971; Piotrowska / Goslar 2002). Before extraction, carbon and nitrogen content were measured using Flash EA 1112 Series (ThermoScientific). The sample was mechanically powdered and treated with 2M HCl and 0.1M NaOH at room temperature. After each step, the sample was centrifuged and the residuum was collected. The extraction of collagen was processed in HCl (pH = 3, 80 °C, 10 h), and after centrifugation, the residuum was removed. The extracted collagen was then ultra-filtered on pre-cleaned Vivaspin 15 MWCO 30 kD filters. The collagen quality was assessed based on the C / N ratio (2.7-3.5) and collagen yield (above 0.5 %).

The collagen sample was measured using the spectrometer Compact Carbon AMS (National Electrostatics Corporation, USA). The conventional radiocarbon age was calculated using the correction for isotopic fractionation basing on the $^{13}C/^{12}C$ ratio measured simultaneously. Calibration of the radiocarbon date was performed using OxCal ver. 4.2 (2014) against INTCAL13 ^{14}C calibration curve (Reimer et al. 2013).

The bone collagen was also measured for the carbon and nitrogen stable isotope ratio in the Stable Isotope Laboratory, Goethe University, Frankfurt (Germany). The sample of collagen was analysed using Flash Elemental Analyzer 1112 (ThermoFisher) connected to the continuous flow inlet of a MAT 253 gas source mass spectrometer (ThermoFisher). External analytical precision is usually better than ± 0.2 ‰ for C isotopes and ± 0.3 ‰ for N isotopes. Two-point corrections are performed both for C and N isotopes running USGS 24, IAEA-CH-7, IAEA-N1 and IAEA-N2 along with the samples. The collagen quality was assessed using the C / N ratio within a range of 2.9-3.6 (DeNiro 1985). Carbon and nitrogen stable isotope values are expressed concerning to international standards Vienna PeeDee Belemite for carbon and Ambient Inhalable Reservoir for nitrogen and expressed in per mill (‰).

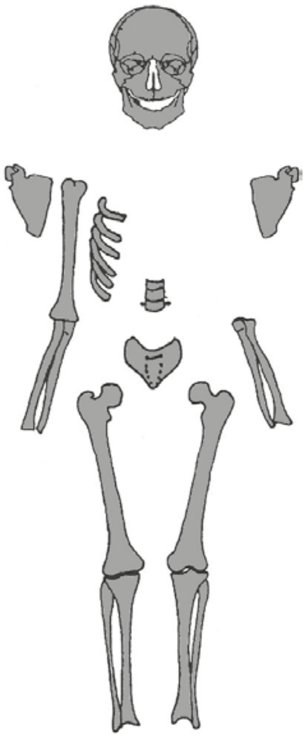

Fig. 4 The completeness of the skeleton from Bagicz. – (Illustration R. Fetner).

RESULTS

The completeness of the skeleton is presented in **figure 4**. The age based on dental attrition was estimated of being between 25 and 35 years old. The morphology of the skull and dimensions of the long bones are female. The estimated stature was between 145 and 147 cm. Human remains were radiocarbon dated to 2035 ± 30 BP [POZ-105174]. The calibrated date is between 160 BC-133 BC (4.9 %), 117 BC-30 AD (88.3 %) and 38-50 AD (2.2 %).

The C / N ratio of extracted collagen was 3.55, measured $\delta^{13}C_{VPDB}$ was -20.5 ‰, and $\delta^{15}N_{AIR}$ was 12.3 ‰. Measured $\delta^{13}C_{VPDB}$ for enamel carbonate was -14.1 ‰, the $\delta^{18}O_{VPDB}$ was -6.3 ‰. The calculated value of $\delta^{18}O_{VSMOW}$ was 24.4 ‰, while the average value of consumed water was -9.8 ‰. The $^{87}Sr/^{86}Sr$ value for the enamel is 0.7116.

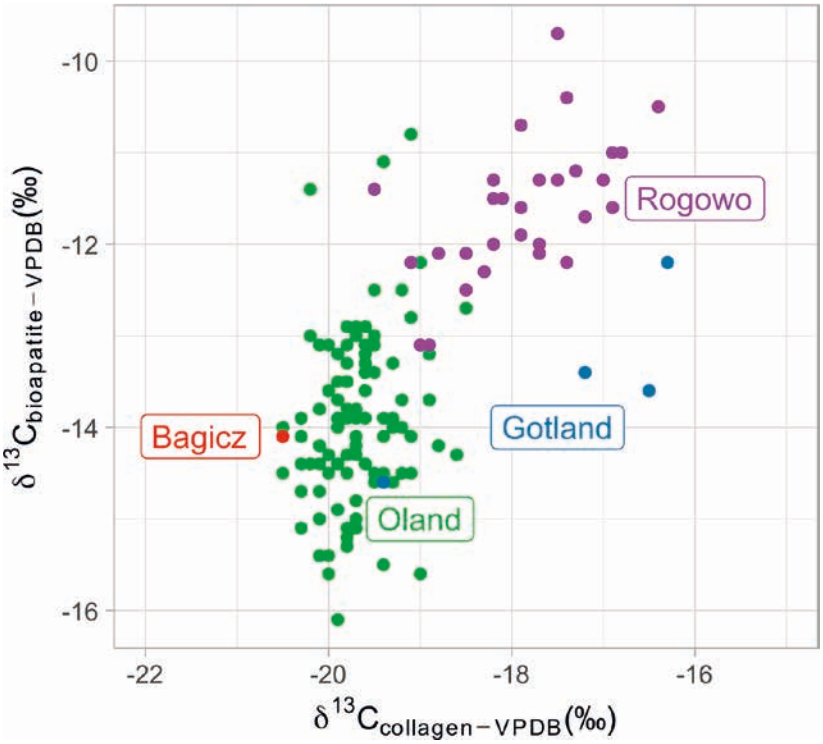

Fig. 5 Comparison between $\delta^{13}C$ of bone collagen and enamel carbonate for the inland population (here represented by Rogowo) and coastal populations (Gotland and Oland) and the individual from Bagicz. – (Data after: Kosiba/Tykot/Carlsson 2007; Reitsema/Kozłowski 2013; Wilhelmson 2017).

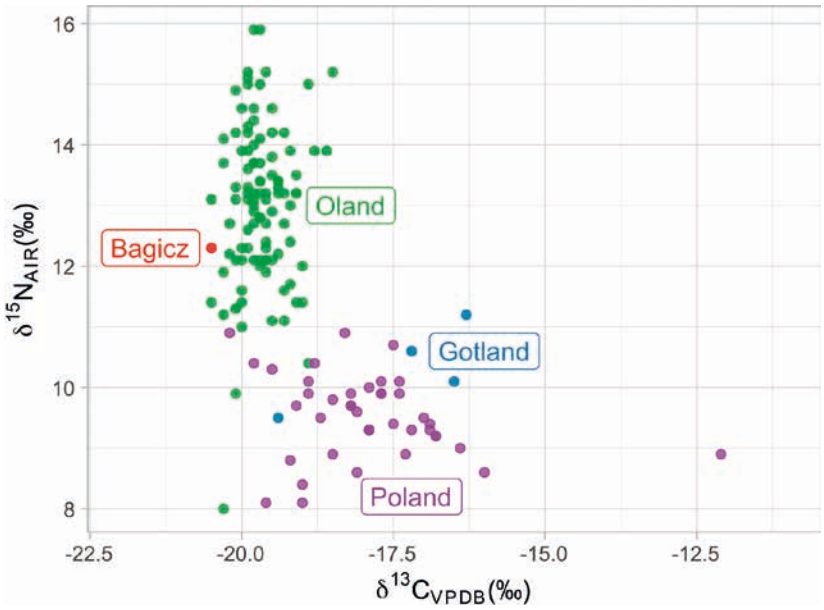

Fig. 6 Comparison between carbon and nitrogen stable isotope values of the human population from the region of Southern Baltic Sea. – (Data after: Kosiba/Tykot/Carlsson 2007; Pospieszny/Bełka 2016; Reitsema/Kozłowski 2013; Wilhelmson 2017).

DISCUSSION

Diet

The $\delta^{13}C$ values of the individual are relatively low and typical for a diet based on C_3 plants without significant share neither of the marine resource nor C_4 plants (**fig. 5**). High $\delta^{15}N$ values can be interpreted as either high animal protein intake, consumption of animal proteins enriched in heavier nitrogen isotopes (freshwater fish), or physiological stress. The individual expresses similar values found in individuals from other popula-

tions living at the Southern Baltic Sea in the 1st millennium AD (Wilhelmson 2017; Kosiba/Tykot/Carlsson 2007) (**fig. 6**).
The relatively low value of $\delta^{13}C$ in both collagen and bioapatite (**fig. 5**) raises questions about the absence of millet and marine resources in the diet. Millet, along with wheat and rye, was one of the most common cereals cultivated in Central Europe in the 1st millennium AD. The consumption of millet is proved by stable isotope analysis of human individuals from Rogowo (woj. kujawsko-pomorskie/PL; Reitsema/Kozłowski 2013) and Karczyn-Witawy (woj. kujawsko-pomorskie/PL; Pospieszny/Bełka 2016). Individuals from Rogowo express $\delta^{13}C$ values for bone collagen of -17.9 ± 0.7‰ and bioapatite -11.6 ± 0.8‰, while for $\delta^{15}N$: 9.7 ± 0.5‰. Individuals from Korczyn-Witawy express $\delta^{13}C$ values for bone collagen of -18.3 ± 2.4‰ and for $\delta^{15}N$: 9.2 ± 1.0‰. Moreover, in Rogowo, gender-based consumption of millet was observed, here females consumed millet more commonly. Hence, it is surprising that millet consumption cannot be visible in $\delta^{13}C$ values.
High $\delta^{15}N$ values are typically explained as high animal protein intake. Proteins of herbivores are enriched in heavier nitrogen isotopes relative to consumed plants, and its consumption should enrich tissues of the omnivorous/carnivorous consumer even more. However, the difference between the individual and herbivorous animals from the Southern Baltic Sea basin (n = 22, $\delta^{15}N$ = 6.7 ± 1.6‰, Etu-Sihvola et al. 2019) is $\Delta^{15}N_{Bagicz\text{-}herbivores}$ = 5.6‰ (see **fig. 7**). The difference is great and either the female from Bagicz consumed animal proteins only or the consumed animal proteins were characterized by high $\delta^{15}N$ values. Very high $\delta^{15}N$ values can be observed among suckling mammals, omnivores and fish (Schoeninger/DeNiro 1984). Since suckling mammals and omnivores would enrich both $\delta^{13}C$ and $\delta^{15}N$ values, high values of both ratios should be observed in tissues of the individual, which is not the case. Fish commonly express high values of $\delta^{15}N$, but only freshwater fish occupying lakes and rivers express low $\delta^{13}C$ values. Marine fish, freshwater fish living in brackish water, typical for estuaries, fish migrating between both environments express not only high $\delta^{15}N$ values but also high $\delta^{13}C$ values. Therefore, only significant consumption of freshwater fish can result in elevated $\delta^{15}N$ values with moderate $\delta^{13}C$ values.
Physiological stress is a competing explanation for the high $\delta^{15}N$ values but is rarely observed in archaeological remains. Usually bone turnover is too slow to preserve short episodes of stress. For example, a study on women buried at Spitalfields (London) showed no difference to the $\delta^{15}N$ value of bone collagen of women who were never pregnant and those who gave birth to several children (Nitsch/Humphrey/Hedges 2010). In theory, women who had several children underwent several few-months-long periods of malnutrition, when the nitrogen stable isotope ratio changes significantly, still no change in their long bones was observed. The root of the third molar develops for c. 5 years, therefore short episodes of stress should not be visible in the $\delta^{15}N$.

Chronology

Artefacts present in the coffin allow for dating the burial to phase B2-B2/C1 (110/120-160 AD) of the Roman Iron Age in Central Europe. On the other hand, the radiocarbon dating indicates older periods (2nd century BC - middle of the 1st century AD; Wołągiewicz 1980, 45). The radiocarbon dating of the burial seems to be about approx. 150 years older than the chronology of artefacts found with the female from Bagicz. This can be an effect of either misclassification of the artefacts or what is more likely a reservoir effect.
Since the site of Bagicz is located at the seashore, the reservoir effect has to be taken into consideration. As mentioned above, fish consumption can affect radiocarbon dating. Carbon present in aquatic ecosystems is depleted in ^{14}C isotopes; therefore, the flora and fauna of aquatic ecosystems seem to be older than it is (Philippsen 2013; Ascough/Cook/Dugmore 2005). Animals and humans consuming fish can be in effect

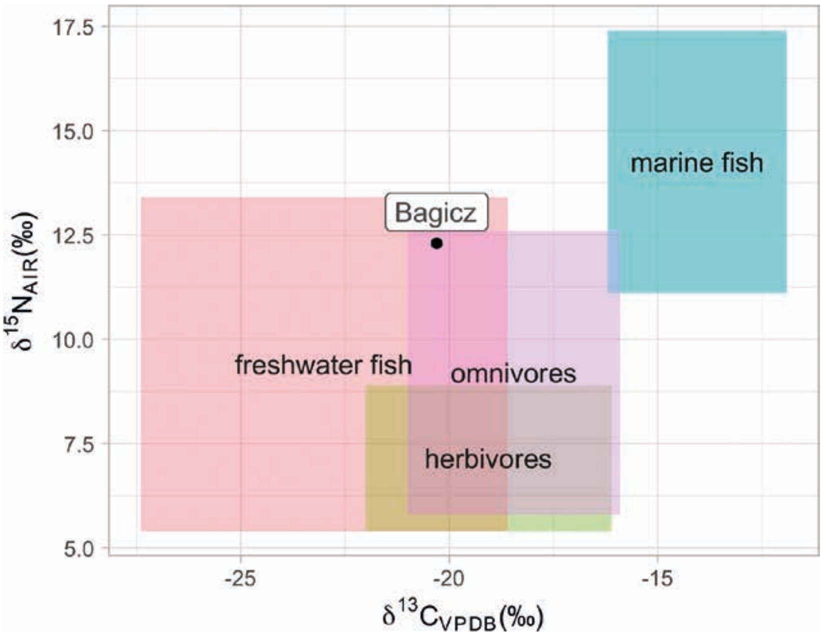

Fig. 7 Results of the carbon and nitrogen stable isotope analysis of the female from Bagicz in the context of animal data from the region of Southern Baltic Sea. – (Animal data after: Etu-Sihvola et al. 2019).

depleted in ^{14}C isotopes relative to their non-fish eating counterparts. The stable isotope composition of bone collagen, especially high $\delta^{15}N$ and moderate $\delta^{13}C$ values advocate of freshwater fish consumption, which could be a cause of reservoir effect in this case.

The hydrology in this area is complex and marine and inland water can mix. Therefore, it is difficult to estimate the possible impact of fresh or marine water on ^{14}C results. Of course, in the diet of the women from Bagicz, there are no traces of marine food, however, we cannot exclude that some inland water bodies, and their fish, did not express low ^{14}C content. It seems that in this case it will be necessary in the future to date a larger series of samples from cemeteries in this region, especially from nearby barrow site Bagicz 22.

Comparisons between grave inventory and radiocarbon dates were conducted for a few Wielbarkian cemeteries. For example, research conducted on the material from the Czarnówko cemetery showed that results of ^{14}C can be correlated with archaeological data and in most cases, they overlap. In the case of some incompatibility, there were always some simple explanations, for example, samples of carbon originating from the older grave. However, in Czarnówko, materials such as fragments from a wooden coffin, charcoal, or textiles have been dated, not the bone material of the deceased, so the reservoir effect had not been taken into account (Michalska / Benysek / Andrzejowski 2015).

Provenance

Post-glacial sediment tills, sands, gravel and slits deposited here during the Vistulian, which exhibits relatively high $^{87}Sr/^{86}Sr$ values, cover the northern and central parts of Poland. According to Hoogewerff et al. (2019), the area of Further Pomerania expresses values of bioavailable (geological) strontium isotopes between 0.7110 and 0.7120. These observations can be supported by studying water from Drawa (0.7104-0.7107) and Gwda (0.7105), and local rivers cutting glacial deposits (Zieliński et al. 2016). Values of river water express mixed values between geological strontium and precipitation water (0.7092), therefore, the values are lower than presented in the study of Hoogewerff et al. (2019). At Drawsko (woj. zachodniopo-

morskie/PL), an archaeological site situated on post-glacial deposits of the Vistulian, animal remains were used to obtain the local range between 0.7082 and 0.7121 (Gregoricka et al. 2014).
The individual, with $^{87}Sr/^{86}Sr$ value of 0.7116, is placed in the range proposed by Hoogewerff et al. (2019) and Gregoricka et al. (2014), and above the ranges for rivers. Considering these data, this individual can be of local origin.
The local variation of drinkable water in the area of Bagicz can be determined by calculation of precipitation. Oxygen stable isotope values for Bagicz were calculated using »The Online Isotopes in Precipitation Calculator« (Bowen 2020; Bowen/Revenaugh 2003; IAEA/WMO 2015). The estimated value was $\delta^{18}O_{VSMOW}$ = -8.3 (±0.2)‰. The second source of information are geohydrological studies of groundwater in Pomerania. The $\delta^{18}O_{VSMOW}$ values for shallow waters varied between -10.3 and -6.6‰ (Pruszkowska/Malina 2008).
The assessed value of consumed water for the individual was -9.8‰. This value is lower than estimated meteoric water but within a range of groundwater. Considering the expected variation between the water source and stable isotope proportion in the carbonate, isotope evidence indicates a local origin for this individual.

Cultural context

The results of the bioarchaeological analysis made our understanding of this individual more complex, but also more complicated and open for various interpretations. One of the problems interpreting the Wielbark Culture is the absence of data about its economy. However, it seems that the deceased had lived near a marine area where natural food, in her case, should be fish and marine mammals, for example, seals which are a quite easy prey on the coast. From the Wielbark Culture, there are no known fishhooks or other items that could be related to fishing. However, this does not exclude an economy based on marine resources. On the one hand, we have a community, which for some reason had a taboo on weapons and tools in funeral rites. On the other hand, they could use organic nets, harpoons, and hooks. Finally, a small number of recognized settlements, especially in the coast area, does not constitute a reliable conclusion that this population did not produce such tools.
At the same time, palynological studies from the forest, about 2 km away from the burial site indicate that during the Roman Period, agriculture developed in this area although probably in small enclaves. For almost the entire period, recorded in the pollen profile (Neolithic - Early Middle Ages), there are numerous traces of charcoal associated with the human economy in this area. On the other hand, those microcharcoals at least partially in the Roman Iron Age may be a result of cremation practices and use of the burial mound of the Wielbark Culture cemetery site Bagicz 22 (Chmiel-Chrzanowska/Adamczyk/Bloom 2019).
Unfortunately, in the case of the Wielbark Culture, a small number of known and excavated settlement sites from Pomerania is a problem. Slightly older research from Poland for this period indicates the existence of different sizes of settlement clusters, depending on the economical basis as well as the size of the inhabited population. Therefore, we do not know what the relations are between known cemeteries in the Bagicz area and still unknown settlement sites.
Another issue here would be the social status of the deceased. Interpretations of the grave from the cliff on the cultural background led us to carefully assume that it had not been in fact a single grave but rather part of a larger cemetery. The burial in a log coffin could indicates a higher social position of the deceased. This kind of practice is well known from many Wielbarkian cemeteries, like Kowalewko 12 (woj. wielkopolskie/PL) or Nowy Łowicz 2 (woj. zachodniopomorskie/PL) (e. g. Skorupka 2001; Cieśliński/Kasprzak 2006). However, coffins may be hard to notice in archaeological material, due to the fact that on most Wielbarkian cemeteries organic materials are poorly preserved.

In general, burials in coffins in the Wielbark Culture are not rare. The deceased was mostly buried directly in the ground in logs or coffins. Furthermore, traces of more complicated wood structures are known. In Weklice (woj. warmińsko-mazurskie/PL), graves 208 and 218 had wooden structures. In rich grave 218, the so-called Goth Princess, traces of wooden structures were interpreted as traces of the framework of a pit (cf. Okulicz-Kozaryn 2005). However, it should be mentioned that all different wood constructions were discovered mostly in adult graves. Coffins were found in graves, which were not necessarily richly equipped. It is also interesting that in southern Scandinavia the deceased were buried in coffins made from sandstone (Skaarup 1976).
It seems that some information about the social position of the individual can be concluded from the results of the nitrogen and carbon stable isotope analysis. The research from Rogowo showed that the diet in the Wielbark Culture society could vary depending on gender (Reitsema/Kozłowski 2013). However, in the case of Bagicz, only one grave was analysed; therefore, more data from this area is needed to draw some relevant conclusions. At this point, both the equipment of the grave and traces of paleopathology showed that we are dealing rather with a typical female representative of the Wielbark Culture than a »princess«, especially that modern research showed that the grave of the individual was not, in fact, a single one (Chmiel-Chrzanowska 2018b).

CONCLUSION

The results of the present study on one hand gave us many new and quite surprising data, as the diet based on land resources rather than expected marine subsistence. At the same time, many new questions have emerged that will need to be worked out, taking into account the analysis of a larger series of deceased from this area.
Radiocarbon dating of remains from Bagicz shows a calibrated date between 160 BC-133 BC (4.9 %), 117 BC-30 AD (88.3 %), and 38 AD-50 AD (2.2 %), so it is significantly different from archaeological dating – 110/120-160 AD. It seems that it is rather a reservoir effect than a misclassification.
The diet of the individual was similar to those of coastal populations from the Baltic Sea basin as it is suggested by isotopic proportions based on plants and animal protein with freshwater fish, devoid of millet and marine resources. Based on the Sr isotopes ratio, this individual fits in the local environment. This kind of situation led us to the question of why this woman who was born and lived so close to the sea did not eat sea fish and marine mammals?
The most important conclusion, after the isotopic analysis, is that we can reflect on the economy of the Wielbarkian society, which was until now almost absolutely unseen in this part of the coast. Due to the very poor state of research on Iron Age settlements and the specific taboo in the Wielbark Culture, we had almost no data about their economy. Some exceptions are palynological data from selected cemeteries. Those, however, show only plants cultivated in the areas nearby, whereas isotope results present us more direct evidence of the use of both wild and domesticated animals. With this being said, the composition of the diet of the individual combined with the results of the palynological analysis has shown a specific use of environmental resources of this particular habitat on the Baltic Coast. Despite that, the analysis only gives us information about one individual. These results led us to assume that future bioarchaeological research conducted in the region will deliver new data, and thus will allow us to draw more detailed conclusions.
The social status of the deceased, till now connected with a high position in the society seems not to be confirmed by the bioarchaeological data. Although results should be compared with larger populations

within the region. Also, the analysis of a cultural background showed that we are dealing with typical representatives of the Wielbarkian society.

In past studies, her high social status was concluded mainly due to the presence of organic materials. However, it cannot be ruled out that similar ones would be found in other burial grounds of the Wielbark Culture, as evidenced by traces of coffins in graves on almost all excavated cemeteries. The goods from the deceased seem relatively modest taking into account burials of similar chronology from Pomerania. Therefore, the organic materials noted in original reports are most likely a result of exquisite preservation conditions rather than suggested the high social position of the deceased.

With the simultaneous growing series of bioarcheological analyses with more detailed palynological data, we will be able to draw, in the future, even more, interesting conclusions. An indisputable issue is a research on the origin of representatives of the Wielbark Culture in this area and more general, the entire Southern Baltic Coast. In this aspect, Bagicz seems to be an excellent testing field, due to at least three cemeteries located near the coast, including the barrow cemetery. Also, at the level of a single grave, the obtained data adds a lot to the biography of this individual from Bagicz and in a sense enhances the image of the settlement of the Wielbark Culture in this region of the Baltic Coast.

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Zusammenfassung / Summary / Résumé

Die Geschichte einer Frau – Neue bioarchäologische Daten zur Deutung eines römischen Grabes aus der Eisenzeit in einem Holzsarg aus Bagicz (woj. zachodniopomorskie / PL)

1899 wurde an der Ostseeküste in Bagicz ein Holzsarg entdeckt. Die menschlichen Überreste wurden ^{14}C-datiert auf 160 cal BC - 50 cal AD, im Gegensatz zu Artefakten, die diese Bestattung zeitlich in die Phase B2-B2/C1 (110/120-160 n. Chr.) der Römischen Eisenzeit einordnen. In diesem Fall muss ein Reservoireffekt in Betracht gezogen werden. Die $\delta^{13}C_{VPDB}$-Werte unterstützen jedoch nicht den marinen Fischkonsum. Die Werte sind niedrig und typisch für eine C_3-basierte Ernährung. Hohe $\delta 1^{5}N_{AIR}$-Werte können entweder als eine hohe Aufnahme von tierischem Protein oder als Stress interpretiert werden. Ein signifikanter Verzehr von Süßwasserfischen kann zu erhöhten $\delta^{15}N$-Werten mit mäßigen $\delta^{13}C$-Werten und zur Erhöhung des ^{14}C-Alters der Individuen führen. Die Ergebnisse werfen auch Fragen über das Fehlen von Hirse und Meeresressourcen in der Nahrung auf. Manchmal kann der Unterschied in der Ernährung durch die nichtlokale Herkunft der Individuen erklärt werden. Die Provenienz wurde durch die Analyse des Sauerstoff- und Strontiumisotopenverhältnisses untersucht. Die gemessenen Werte weisen höchstwahrscheinlich auf eine lokale Herkunft hin. Eine weitere Frage wäre hier die nach der sozialen Stellung der Verstorbenen. Die sorgfältige Interpretation des Grabes an der Abbruchkante vor seinem kulturellen Hintergrund ließ vermuten, dass es sich nicht um ein Einzelgrab gehandelt hat. Zu diesem Zeitpunkt zeigten sowohl die Grabbeigaben als auch die bioarchäologischen Ergebnisse, dass wir es nicht mit einer »Prinzessin«, sondern mit einer typischen weiblichen Angehörigen der Wielbark-Kultur zu tun haben.

The Story of one Woman – New Bioarchaeological Data on the Interpretation of a Roman Iron Age Grave in a Log Coffin from Bagicz (woj. zachodniopomorskie / PL)

In 1899 a log coffin was discovered on the Baltic seashore in Bagicz. Human remains were radiocarbon dated to 160 cal BC - 50 cal AD, contrary to artefacts that date this burial to phase B2-B2/C1 (AD 110/120-160) of the Roman Iron Age. In this case a reservoir effect has to be taken into consideration. However, $\delta^{13}C_{VPDB}$ values do not support the marine fish consumption. The values are low and typical of a C_3 based diet. High $\delta^{15}N_{AIR}$ values can be interpreted as either a high animal protein intake or stress. Significant consumption of freshwater fish can result in elevated $\delta^{15}N$ values with moderate $\delta^{13}C$ values and in aging the radiocarbon age of the individuals. The results also raise questions about the absence of millet and marine resources in the diet. Sometimes the difference in the diet can be explained by the non-local origin of the individuals. The provenance was studied by the analysis of the oxygen and strontium isotope ratio. The measured values most likely indicate a local origin. Another issue here would be the social position of the deceased. The careful interpretation of the cliff grave against the cultural background led us to assume that it had not in fact been a single grave. At this point, both grave goods and bioarchaeological results showed that we were dealing with a typical female member of the Wielbark Culture, rather than a »princess«.

L'histoire d'une femme – nouvelles données bioarchéologiques pour l'interprétation d'une sépulture de l'âge du Fer romain dans un cercueil en bois de Bagicz (woj. zachodniopomorskie / PL)

En 1899, on a découvert un cercueil en bois à Bagicz sur la côte balte. Les restes humains ont été datés au radiocarbone entre 160 cal BC et 50 cal AD, une datation qui diffère de celle livrée par les offrandes (phase B2-B2/C1 de l'âge du Fer romain, soit 110/120-160 ap. J.-C.). Il faut envisager un effet de réservoir dans ce cas-ci. Mais les faibles valeurs $\delta^{13}C_{VPDB}$ ne plaident pas pour une consommation de poissons de mer et sont plutôt caractéristiques d'une alimentation basée sur le C_3. Les valeurs $\delta^{15}N_{AIR}$ élevées indiquent soit un apport élevé de protéines animales ou un stress. Une consommation significative de poissons d'eau douce peut donner des valeurs $\delta^{15}N$ élevées pour de faibles valeurs $\delta^{13}C$, augmentant ainsi l'âge radiocarbone des individus. Ces résultats soulèvent des questions sur l'absence de millet et de produits marins dans l'alimentation. La différence qui se dessine dans l'alimentation s'explique parfois par l'origine étrangère des individus. L'origine fut déterminée en analysant les ratios isotopiques de l'oxygène et du strontium. Les valeurs mesurées indiquent fort probablement une origine locale. Une autre question serait de déterminer la position sociale du défunt. L'interprétation dans un contexte culturel de cette tombe au bord d'une falaise dunaire laisse supposer, avec beaucoup de précaution, qu'il ne s'agissait en fait pas seulement d'une seule sépulture. Tant les offrandes que les résultats bioarchéologiques ont révélé que l'on se trouve en présence d'une représentante typique de la culture de Wielbark plutôt que d'une »princesse«, vu que de récentes recherches ont montré qu'il ne s'agit pas d'une sépulture unique.

Traduction: Y. Gautier

Schlüsselwörter / Keywords / Mots clés

Wielbark-Kultur / Analyse stabiler Isotope / Osteobiografie / Archäologie an den Klippen
Wielbark Culture / stable isotope analysis / osteobiography / archaeology on the cliffs
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