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SETTLEMENT AND LANDSCAPE HISTORY OF THE NORTHERN FRANCONIAN JURA DURING THE BRONZE AND IRON AGES

Previous regional studies of prehistoric settlement in the southern German Central Uplands (Mischka 2007; Pankau 2007; Sorcan 2011) revealed traces of early occupation mainly in the valleys and lowlands from the beginning of the Neolithic period. This evidence is based on older excavations, monuments such as burial mounds, and mostly stray finds. However, none of these previous studies produced clear evidence of permanent settlement sites on the topographically higher areas (plateaus) of the Uplands.

Better known are other categories of sites on these plateaus, such as hillforts and so-called princely sites. Some of these were already investigated during earlier research projects, e. g. Ipf (Lkr. Ostalbkreis) and Heuneburg (Lkr. Sigmaringen) in the Swabian Jura (Hertlein 1911; Krause 2014; Krausse 2008), Schlossberg near Kallmünz (Lkr. Regensburg) in the Southern Franconian Jura (Sandner 2005), and Ehrenbürg (Lkr. Forchheim) and Staffelberg (Lkr. Lichtenfels) in the Northern Franconian Jura (Abels 1980; 2012). Although around some of these sites interdisciplinary pedological and palaeoecological studies allowed for the reconstruction of anthropogenic landscapes (Ipf: Mailänder/Blümel/Eberle 2010; Schlossberg: Nelle/Schmidgall 2003; Poschlod/Baumann 2010), little is known about Bronze and Iron Age settlements in the rural areas of the Uplands beyond these hillforts and »princely sites«.

Similar results apply to our study area (described below) in the Northern Franconian Jura between the modern cities of Bamberg and Bayreuth. There is evidence of human activity on the plateaus in this region as early as the Neolithic period, as we find a high density of burial mounds, some of them well furnished. We also find ritual sites, e. g. conspicuous rock formations or caves dating to those times (Müller/Seregély 2008; Seregély 2008). The majority of these sites were used continuously during the Bronze and Iron Ages (Berger 1984; Falkenstein 2012). However, aside from this clear proof of human presence, the spatio-temporal scale and nature of a possible further exploitation of this region during the Metal Ages have so far not been clearly established. The plateaus have always been considered unfavourable for settlement and land-use activities since the climate is rougher, the vegetation period is shorter, and the soil quality is lower than in the surrounding valleys and lowlands (Denecke 1992).

Considering that ritual sites and burial mounds of the Late Neolithic and the Metal Ages were already evidenced, we can assume numerous small rural settlements and hamlets on the plateaus likewise to be present for this period. Depending on the difficult environmental conditions mentioned above, land-use activities within the peripheries of plateau settlements may have been different from, or even complementary to activities around the valley and lowland sites. Settlement activities may have taken place mainly in the valleys, while settlers occasionally used the plateaus for (wood) pasturing or farming.

Conclusive evidence of such rural occupation and land use would enable us to better understand the cultural history and development of a typical Upland region as well as the human impact on the landscape. Most likely, this impact involved the clearing of vegetation by fire to open land for settlements, pastures and agricultural fields. Moreover, the cultivation of the landscape must have induced soil erosion, leading to the formation of geoarchives such as colluvial sediments. Colluvial layers and alluvial sediments in river plains have been used in numerous studies to reconstruct anthropogenic changes of the landscape (Bork/Lang

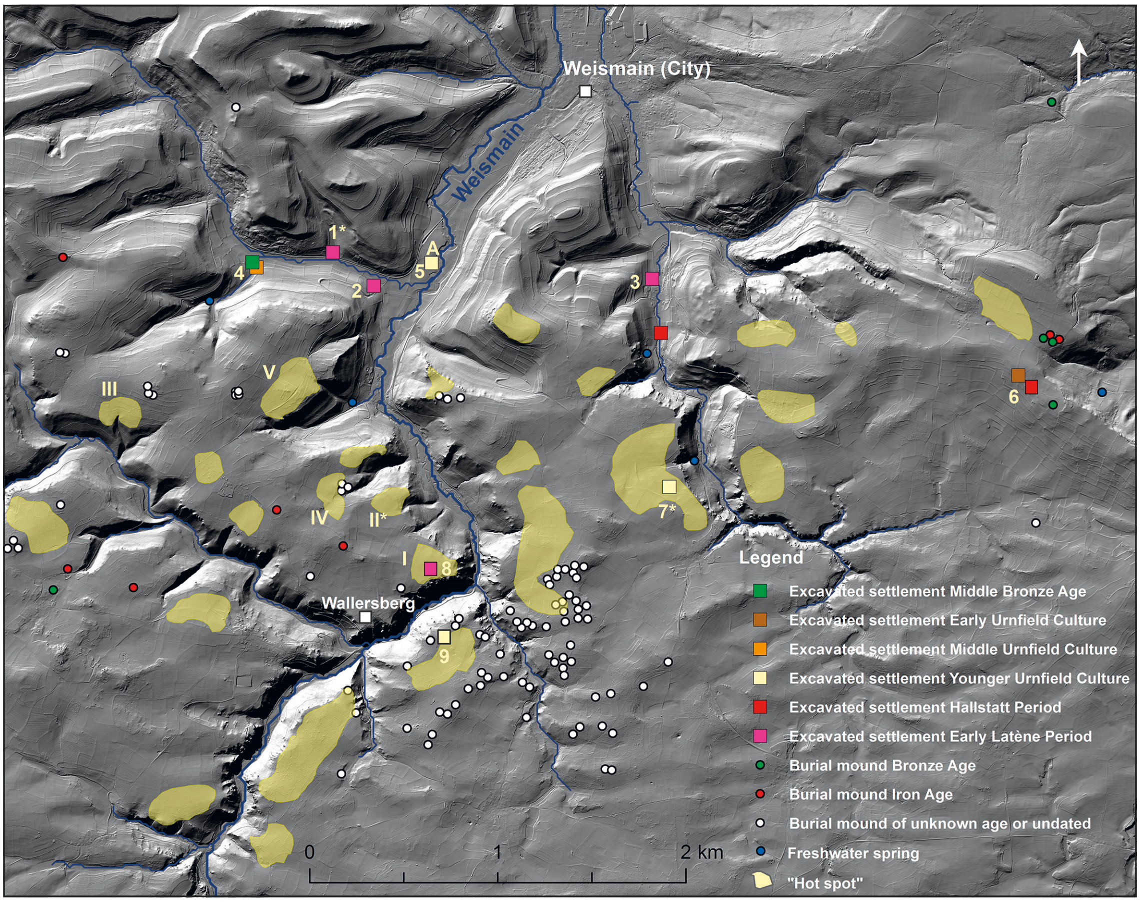


Fig. 1 Map of our study area with archaeological (Arabic numerals and letter A) and geoarchaeological (Roman numerals) sites examined. – The white square marks the modern settlement of Wallersberg (Lkr. Lichtenfels). Radiocarbon dating of all sites is given in **tab. 1**; sites marked with * are described in detail in the text. – (Map K. Kothieringer / T. Seregély; source relief model DEM 1 m, Landesamt für Digitalisierung, Breitband und Vermessung, Munich).

2003; Dotterweich 2008; Mäckel/Schneider/Seidel 2003; Stolz/Grunert 2006). Adjacent to our study area, M. Fuchs et al. (2010; 2011) recently evidenced Holocene sediment dynamics based on anthropogenic soil erosion within the catchment of the Aufseß river.

In this pilot study we present first results of an interdisciplinary archaeological and pedological research project to reconstruct Metal Age settlement and landscape history in a meso-scale catchment in the Northern Franconian Jura. The study was conducted between 2013 and 2015 by the Otto-Friedrich-Universität Bamberg and is currently followed by a multi-annual interdisciplinary research project comprising systematic, combined archaeological and pedological studies, the results of which will be reported in future publications.

STUDY AREA

The Northern Franconian Jura is a low mountain range in northern Bavaria and part of the German Central Uplands. Within this mountainous region, our investigations stretch over an area of about 125 km² and cover the catchment of the Weismain river, a tributary of the upper Main river (**fig. 1**). Geologically, this region is characterized by Jurassic sedimentary rocks such as dolomite, limestone, and sandstone, as well as Pleisto-

cene loess deposits. Periglacial cover-beds were formed by processes of solifluction on the plateaus and slopes of the mountains during the Pleistocene. Due to this soil creep, the cover-beds contain coarse fragments of weathered dolomite, limestone, residual clay, as well as reworked sand and loess. All these components provide the parent material for the Holocene soil formation. While the undulating plateaus are dominated by Cambisols, Luvisols, and rendzic Leptosols, it may be assumed that Fluvisols and Stagnosols (FAO 2014) have developed in the alluvial plains. An altitudinal gradient of up to 200 m has formed between the valleys and the plateaus (Meyer / Viohl / Zorn 1972) since the Weismain river and its smaller tributaries have deeply incised the plateaus (approx. 480 m a. s. l.). Due to the karstic relief, the plateaus are characterized by a scarcity of water, a fact that has always limited settlement and cultivation activities in this region (Gunzelmann 1995). Few freshwater springs exist along the slopes at the boundaries of the Jurassic sedimentary strata (Dogger – Malm; **fig. 1**, blue dots). The recent landscape is dominated by beech forests, arable land and calcareous grasslands, which are in use as pasture for livestock grazing (mainly sheep). With a mean annual precipitation of about 800 mm and a mean annual temperature of 7.5 °C (city of Weismain [Lkr. Lichtenfels], 1961-1990), our study area reveals typical values for northern Bavaria (Deutscher Wetterdienst 2017).
Archaeologically, only a few of the above-mentioned burial mounds have been investigated in detail, among them the well-furnished mounds at Neudorf-Görau (Lkr. Lichtenfels; Pászthory / Mayer 1998). However, over the past decades, amateur archaeologists, mainly detectorists, recorded several stray finds in recently ploughed horizons within our study area. These were mainly metal finds and sherds that indicated prehistoric settlement activities, whereby the majority of these finds were either insufficiently dated or not at all. Additionally, so far no further systematic research has been carried out on potential archaeological settlement features.

METHODS

Site location analysis

Prior to our fieldwork, we performed GIS-based spatial analysis using ArcGIS standard tools (e. g. 3D Analyst) to delimit the area of prospection and to locate potentially favourable arable land. Topographically, we mainly focused on the plateaus of our study area. Assuming Bronze and Iron Age settlement activity in proximity to burial mounds, a number of factors were taken into account for site location analysis. These were (a) the visibility of known Bronze and Iron Age burial mounds within a certain radius (up to 1 km); (b) the soil type (presence of favourable Cambisols and Luvisols especially on Loess); and (c) the easy access to freshwater resources (springs and rivers). We used geodata on geology, soil type, and topography, as well as a hillshade derived from a digital elevation model with a grid size of 1 m (Landesamt für Digitalisierung, Breitband und Vermessung, Munich; see **fig. 1**). Based on these variables, we calculated new GIS layers that showed areas with a high probability for settlement and cultivation activity (so-called hot spots), which were the starting points for the subsequent fieldwork.

Archaeological fieldwork and analysis

The archaeological fieldwork consisted of a combination of surface survey, geophysical prospection (fluxgate magnetic field gradiometer »Grad601«, Bartington / GB), and soil augering (type »Edelman«, Eijkelkamp / NL). After the fields had been ploughed and washed-off by rain, systematic pedestrian surveys were carried out mainly on parcels in which amateur archaeologists had previously found traces of prehistoric settlement activity. Further surveys were conducted at hot spots determined by site location analysis. Walked lines were narrowly spaced (1-2 m apart), and every object discovered was measured individually by means of differential GPS (Leica CS15/GS15). After cleaning, the finds were categorized by age (prehistoric or medieval/modern), size (only sherds) and type (ceramics, burnt clay, bones, slag, metal finds, lithic artefacts or fragments). After merging magnetograms and distributions of stray finds in GIS, concentrations of stray finds close to magnetic anomalies were interpreted as probable archaeological features. Additionally, magnetic anomalies were verified as geological or archaeological features by soil augering. Based on these results, several archaeological excavations were carried out at selected sites to investigate prehistoric features such as pits.

Archaeozoological and -botanical analysis

Animal bones found during the excavations were analysed to study livestock husbandry and the role of hunting (analyses by Ch. Baumann, Eberhard Karls Universität Tübingen). Soil samples were taken from all archaeological features to obtain charcoal and botanic macro-remnants. These analyses provide valuable data on the former vegetation and the economy and possible changes during the Bronze and Iron Ages (analyses by D. Jansen, Christian-Albrechts-Universität zu Kiel).

Soil analysis

Off-site soil survey and prospection were mainly conducted within the hot spots (see the section Site location analysis) on the plateaus of the study area, focusing on promontories and sinks with accumulated soil material. Overall, about 60 soil samples were collected using the soil auger »Edelman« on the plateau around the modern settlement of Wallersberg (city of Weismain; **fig. 1**, yellow polygons). All locations of soil sampling were surveyed using differential GPS (accuracy 1-2 cm). While pedological descriptions followed German guidelines of the Ad-Hoc-AG Boden (2005) and were then transferred to FAO (2014) nomenclature, the colours of horizons and layers were determined by means of Munsell (2009) soil-colour charts. At selected locations, mixed samples from each horizon or layer were taken for further laboratory analyses, with special attention to macroscopic charcoal fragments. Standard analytics included (a) the particle size distribution according to Köhn (Deutsches Institut für Normung 2005; DIN ISO 11277); (b) the measurement of pH in $CaCl_2$, following DIN ISO 10390; (c) the determination of calcium carbonate ($CaCO_3$) according to Scheibler (DIN 18129 - ISO 10693); and (d) the measurement of C_{org} according to Riehm/Ulrich (1954). The determination of the type of wood of the charcoal samples was carried out by Doris Jansen (Christian-Albrechts-Universität zu Kiel).

Radiocarbon dating

For age determination of the samples listed in **table 1**, radiocarbon AMS dating was carried out by the Poznańskie Laboratorium Radiowęglowe (Poznan/PL; lab code »Poz«), and by Isotoptech Zrt. (Debrecen/H; lab code »DeA«). Dates were calibrated using OxCal 4.2.4 (Bronk Ramsey/Lee 2013) based on IntCal13 (Reimer et al. 2013).

no.	lab code	sample type	sample depth (cm)	conventional ^{14}C age (BP* ± 1σ)	calibrated calendar age cal BC (2σ)	period
1	DeA-9293	charred crop (*Hordeum vulgare*)	40	2345 ± 22	475-442 BC (4.4 %) **432-379 BC (91.0 %)**	Lt A
2	DeA-10905	charred crop (*Hordeum vulgare*)	50	2377 ± 25	535-528 BC (1.4 %) **521-395 BC (94.0 %)**	Ha D / Lt A
3	DeA-10880	charred crop (*Hordeum vulgare*)	60	2402 ± 27	729-693 BC (6.1 %) 657-655 BC (0.4 %) **543-401 BC (88.9 %)**	Ha D / Lt A
4a	Poz-40961	animal bone (*Sus*)	50	2890 ± 35	1207-1141 BC (13.6 %) **1135-976 BC (81.8 %)**	Ha A2/B1
4b	DeA-6756	animal bone (*Bos*)	110	3137 ± 28	1496-1473 BC (5.5 %) **1462-1375 BC (73.1 %)** 1346-1304 BC (16.9 %)	Bz B/C
5a	DeA-9295	charred crop (*Hordeum vulgare*)	50	2756 ± 22	972-958 BC (4.3 %) **939-833 BC (91.1 %)**	Ha B2/B3
5b	DeA-9516	animal bone (*Capra*)	55	2799 ± 31	**1027-889 BC (90.4 %)** 881-846 BC (5.0 %)	Ha B1/B2/B3
6a	DeA-10873	charred crop (*Hordeum vulgare*)	45	2992 ± 27	1371-1360 BC (1.8 %) **1296-1124 BC (93.6 %)**	Bz C / Ha A1/A2
6b	DeA-11556	charcoal (*Fagus*)	40	2446 ± 22	751-683 BC (28.4 %) 669-638 BC (10.0 %) **591-411 BC (57.0 %)**	Ha C/D / Lt A
7a	DeA-9297	charred crop (*Triticum dicoccum*)	55	2815 ± 25	**1016 – 909 BC (95.4 %)**	Ha B1 / B2
7b	DeA-9300	charred crop (*Triticum dicoccum*)	50	2757 ± 27	975-953 BC (6.9 %) **945-831 BC (88.5 %)**	Ha B2 / B3
8	DeA-12144	charcoal	50	2347 ± 27	507-500 BC (1.1 %) **491-377 BC (94.3 %)**	Ha D / Lt A/B
I	Poz-51352	charcoal (*Quercus*)	110	3285 ± 30	**1629-1500 BC (95.4 %)**	Bz A/B
IIa	Poz-51235	charcoal (*Quercus*)	135	3275 ± 35	**1631-1494 BC (91.4 %)** 1480-1455 BC (4.0 %)	Bz A/B/C
IIb	Poz-51236	charcoal (*Fagus*)	65	125 ± 35	1675-1778 AD (36.9 %) **1799-1942 AD (58.5 %)**	ME
IIIa	Poz-51232	charcoal (*Quercus*)	75	3175 ± 35	**1518-1392 BC (94.1 %)** 1335-1324 BC (1.3 %)	Bz B/C
IIIb	Poz-51233	charcoal (*Carpinus*)	40	300 ± 30	**1489-1604 AD (69.6 %)** 1611-1654 AD (25.8 %)	ME
IV	Poz-51353	charcoal (*Quercus*)	100	2915 ± 35	**1216-1008 BC (95.4 %)**	Bz D / Ha A1/A2/B1
V	DeA-11245	charcoal (*Quercus*)	60	2868 ± 27	**1123-971 BC (90.3 %)** 961-935 BC (5.1 %)	Ha A1 / Ha A2/B1
VI	DeA-12138	charcoal (*Fraxinus*)	80	1251 ± 25	676-866 AD (95.4 %)	MA
A	DeA-9512	wood (*Alnus*)	60	6402 ± 52	**5477-5306 BC (95.4 %)**	EN

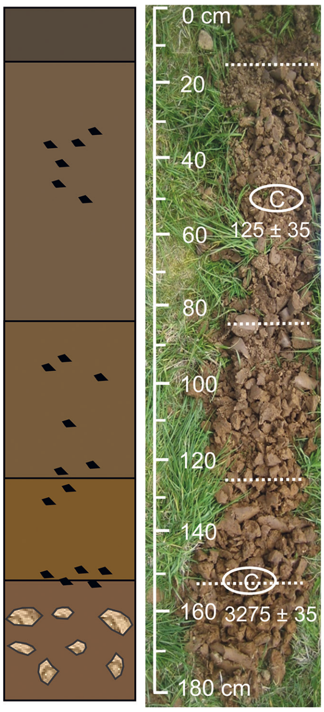
Tab. 1 ^{14}C-dated material from archaeological findings (Arabic numerals), colluvial layers (Roman numerals) and alluvial deposits (letter). – *BP = radiocarbon years before »present« (= AD 1950). – EN = Early Neolithic period. – Bz A = Early Bronze Age (2100-1550 BC). – Bz B/C = Middle Bronze Age (1550-1270 BC). – Bz D = Early Urnfield Culture (1270-1200 BC). – Ha A1 = Older Urnfield Culture (1200-1100 BC). – Ha A2/B1 = Middle Urnfield Culture (1100-950 BC). – Ha B2/B3 = Younger Urnfield Culture (950-800 BC). – Ha C = Early Hallstatt period (800-600 BC). – Ha D = Late Hallstatt period (600-480 BC). – Lt A/B = Early La Tène period (480-250 BC). – MA = Medieval Ages. – ME = Modern Era.

RESULTS

Geoarchaeology

In the course of these preliminary investigations, geoarchaeological fieldwork was conducted within a few selected hot spots on the plateau around the modern settlement of Wallersberg (**fig. 1**) in close proximity

Soil profile



Horizon	Colour	pH	$CaCO_3$ [%]	C_{org} [%]	Grain size distribution [%]		
					<2 µm	2-63 µm	63-2000 µm
Ah	10YR 3/2	6.0	0.1	1.9	20	76	4
B3	10YR 4/3	5.7	0.1	0.7	25	73	2
B2	10YR 4/4	6.0	0.0	0.5	36	57	7
B1	10YR 4/6	6.4	0.2	0.5	47	42	11
B1-Bw	7.5YR 4/4	7.1	2.1	1.2	52	30	18

Fig. 2 Soil profile of hot spot II*, which is exemplary for the soil development in the sinks on the plateaus of the Northern Franconian Jura. – Standard soil data are provided for each horizon as well as conventional ^{14}C ages (BP ± 1σ) of charcoal (C) fragments. Dashed lines indicate the boundaries of single horizons. – (Photo and graphics K. Kothieringer).

to several burial mounds, which are either undated or dated to the Iron Age. Loess deposits are still present especially at leeward locations, indicating a good soil quality over long periods. There are also two freshwater springs downhill to the northeast (**fig. 1**). Typical soils on nowadays eroded hilltops of the plateaus are rendzic Leptosols, i.e. soils with a shallow, humic Ah-horizon lying above the parent material (limestone or dolomite). As these soils turned out to be not relevant for our research questions, they have not been further examined.

One soil profile is exemplary for the soil development in the sinks on the plateau and is thus described in detail in the following (**figs 1**, hot spot II*; **2**). Below a topsoil (Ah) of 18 cm depth, a sequence of three colluvial layers (B1-B3) stretches down to about 1.5 m depth. The soil type is a so-called Anthrosol (FAO 2014). The colluvial layers can be distinguished by their colour, the varying pH values and grain size fractions. In B3 and B2, high fractions of silt-size particles, especially middle and coarse silt, evidence the incorporation of Loess into soil formation processes. Below this sequence lies an *in situ*, solid soil horizon (Bw) with a high amount of clay (> 50 %) induced by long-term, chemical weathering of the parent material (limestone). All layers are decalcified except the one at the transition to the parent material (not shown in **fig. 2**). The decalcification of the soil probably explains the bad state of preservation and also the lack of animal bones in archaeological findings (see section Archaeology). The content of organic carbon (C_{org}) decreases with increasing soil depth; however, there is a noticeable increase of C_{org} up to 1.2 % at the transition of B1 to the *in situ* soil horizon Bw at about 1.5 m depth (**fig. 2**). Here, the presence of a burnt layer is evidenced by a high amount of charcoal fragments which date to the late Early or Middle Bronze Age

(1631-1455 cal BC; **tab. 1**, no. IIa). At 50 cm soil depth, a collective sample of charcoal fragments has been dated to the Modern Era (**tab. 1**, no. IIb). On the plateau of Wallersberg, the thickness of the off-site colluvial layers is highest (overall up to 1 m) in sinks due to the long-term accumulation of the soil material; however, less thick layers (overall ~ 50 cm) are also present on slightly prone promontories as well as at the transition to the adjacent steep slopes. Interestingly, at the upper part of some of the steep slopes (**fig. 1**, hot spot I), colluvial layers have accumulated and distributed in the form of small-scale terraces, which probably are held back by geological ledges at this steep location. Not only at location II, but also at all the other hot spots where colluvial layers have been dated to the Bronze Age (**tab. 1**, nos I, IIa, IIIa, IV and V), the most abundant type of wood of the charcoal is oak (*Quercus*). Further analysis of charcoal fragments of each of the radiocarbon-dated stratigraphic units shows that, beside oak, subordinate wood has been beech (*Fagus*), hornbeam (*Carpinus*), and blackthorn (*Prunus*), which is an indicator for landscape opening subsequent to forest clearance by fire (D. Jansen, pers. comm. 2017).

Archaeology

In the following, we are summarizing the results of the excavation of two settlement sites, one in the valley and one on the plateau.

The site Kasp452 (Kaspauer [Lkr. Lichtenfels]; **fig. 1**, no. 1*) is situated on a southeastern slope near (~100 m) a small tributary of the Weismain river. Two springs at a distance of about 80-150 m probably served as additional freshwater supply. Archaeological features such as pits were detected by magnetic prospection, whereby four of these features were excavated. The two northern pits located more uphill were found below a plough horizon of 25-30 cm (**fig. 3a-c**) and had a depth of up to 35 cm (**fig. 3b-c**). The two southern pits located more downhill were filled with burnt clay fragments that might originate from a burnt house. The surfaces of these features were overlain by a 35 cm thick colluvial layer of medieval/modern age (**fig. 3d**). A humus-rich fossil topsoil was found in one of the trenches. The settlement features could be dated to the Early La Tène period around 400 BC (**tab. 1**, no. 1). From a typological point of view, the finds fit very well into the time span of the radiocarbon dates (**fig. 3g, 1-4**). Typical ceramic types include pots with a grooved rim and a rough surface below (**fig. 3g, 1**) as well as carinated bowls (**fig. 3g, 2-3**). A twisted rod-shaped bronze pendant with incised lines on the head plate was discovered in one of the pits filled with burnt waste (**fig. 3g, 4**). While fragments of animal bones identified as pig and sheep/goat came to light, there was no trace of bone from cattle. Among the charcoal finds, the dominant types of wood were oak (*Quercus*) and beech (*Fagus*), followed by hornbeam (*Carpinus*), pine (*Pinus*), and some broadleaved tree species. In terms of botanic macro-remnants, amelcorn (*Triticum dicoccum*) is the most abundant type, followed by barley (*Hordeum vulgare*) and proso millet (*Panicum miliaceum*).

The site Mods1205 (Modschiedel [Lkr. Lichtenfels]; **fig. 1**, no. 7*) is situated on a gentle northeastern slope on one of the plateaus. A spring at a distance of about 300 m was probably used as a freshwater source. In this part of the plateau, former Loess deposits were completely eroded. As magnetic prospection revealed only geological features, excavation trenches were placed in an area of stray find concentrations. Thus, we detected two pits with a depth of 10-40 cm (**fig. 3e-f**) directly below the plough horizon. Settlement features were dated to the younger Urnfield Culture (Late Bronze Age around 900 BC) (**tab. 1**, no. 7). Among the ceramic finds were pots with slightly protruding cylinder-necked rims (**fig. 3g, 5**) and fragments decorated with fine short narrow slantings produced by means of closely turned, non-wrought metal rings, so-called Attinger Zier (**fig. 3g, 6-7**). Bones were not preserved due to the calcification of soils. Charcoal finds were clearly dominated by oak (*Quercus*), followed by beech (*Fagus*), maple (*Acer*), ash (*Fraxinus*), and

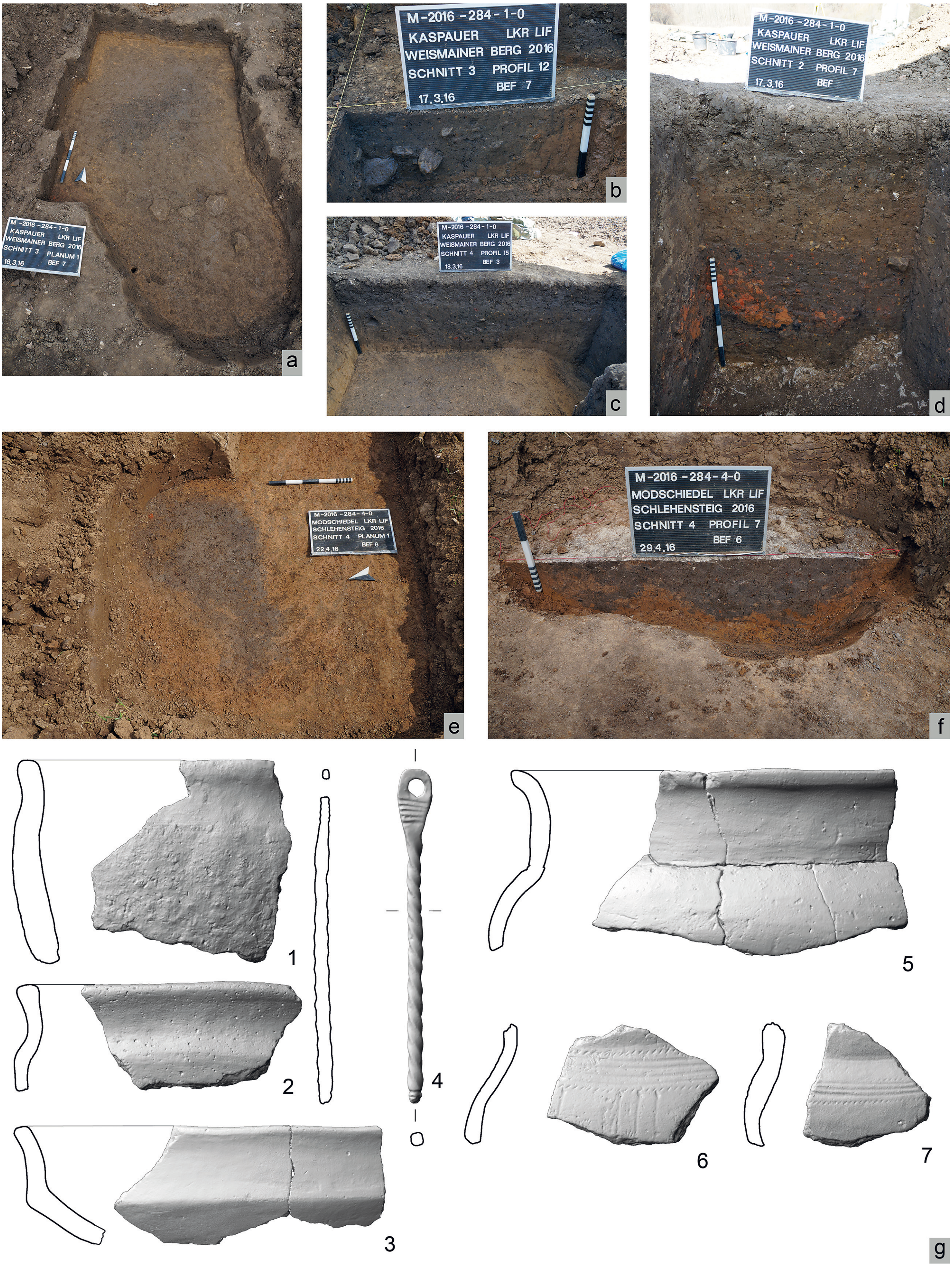


Fig. 3 Archaeological features and finds: **a** Kasp452: feature 7 (northern pit) in planum 1. – **b** Kasp452: feature 7 (northern pit) in profile. – **c** Kasp452: feature 3 (northern pit) in profile. – **d** Kasp452: feature 6/9 (southern pit) with burnt clay below a colluvial layer in profile. – **e** Mods1205: feature 6 in planum. – **f** Mods1205: feature 6 in profile. – **g** finds: **1-3** Kasp452: pottery; **4** Kasp452: bronze pendant; **5-7** Mods1205: pottery. – (Photos T. Seregély). – 1-3. 5-7 scale 1:2; 4 scale 1:1.

minor amounts of some other broadleaved tree species. The most abundant crop was amelcorn (*Triticum dicoccum*), followed by barley (*Hordeum vulgare*), pea (*Pisum sativum*), lens (*Lens culinaris*) and a noticeable amount of proso millet (*Panicum miliaceum*).

DISCUSSION

Methods

The delimitation of the areas of prospection by GIS-based spatial analysis prior to both archaeological and geoarchaeological fieldwork has turned out to be a suitable tool to determine hot spots, comprising (a) past, buried settlement features, and especially (b) off-site colluvial layers, which indicate a human impact through forest clearance by fire. Settlement features are represented by archaeological findings such as the relics of storage, loam and trash pits, and finds such as settlement ceramics, fragments of grinding stones, red loam, charcoal and botanic macro-remnants of decorticated crops, which potentially indicate growth and on-site processing of cereals. Conclusions on livestock husbandry or hunting activities of the Metal Age settlers are so far difficult to draw due to a low amount and an insufficient preservation of animal bones, due to the decalcification of soils.

The combination of methods – GIS-based spatial analysis, field survey, magnetic prospection and soil augering – that we used in order to detect so far unknown settlement traces has generally been successful with some constraints. In the valleys, magnetic prospection turned out to be the most suitable approach. Anomalies predominantly have proven to be archaeological features, whereas clusters of stray finds (mostly ceramic fragments) are more difficult to interpret. This is due to a long-term colluvial dislocation of the stray finds and, accordingly, a colluvial cover of the settlement features below. Moreover, alluvial deposition of sediments due to the meandering of the Weismain river in the past complicates the stratigraphy of the archaeological findings.

On the plateaus, however, a field survey of stray find concentrations is the most suitable method, whereas magnetic anomalies rarely indicate *in situ* findings in the soil. Instead, they are mostly due to geological and pedological formations (karstic cracks, sinks, and reworked soils due to periglacial soil creep). As settlement features especially on hilltops have not been covered and were thus unprotected by colluvial layers, they are often severely eroded, and their preservation is even more endangered by recent ploughing.

Past vegetation

Charcoal fragments extracted from the soil (on-site and off-site) reflect the former potentially available inventory of tree species to a certain degree. However, based on our previous data, it has so far not been possible to decide whether this is due to the anthropogenic selection of timber, or if the fragments do represent the former ratio of species. Overall, the abundance of oak, followed by beech, hornbeam and other predominantly broadleaved tree species indicates a natural vegetation of mixed oak forests on the plateaus, which is typical for the Early and Middle Bronze Age in Central Europe (Anhuf et al. 2003).

Further information on the former vegetation history in our study area could be derived from pollen; however, pollen preservation is insufficient on the plateaus, with karstic dolines as only potential geoarchives. In the valleys, the pollen preservation is acceptable in Stagnosols and alluvial sediments, which have been surveyed in the course of excavations at site no. 5 (**fig. 1**) in close proximity to the Weismain river. Here, a peat layer was dated to the mid-6th millennium BC (**tab. 1**, no. A), and samples were taken for pollen analysis. The pollen spectrum of this former wet meadow vegetation reflects a typically mixed alder forest with lime and elm trees.

Early settlement and land-use activities

In terms of the beginning of settlement and land-use activities, our preliminary combined data suggest a first, significant human impact on the landscape in the Middle Bronze Age (16th-14th century BC) both in the valleys and on the plateaus. Interestingly, so far the earliest evidence for human activity is indicated by colluvial layers (**tab. 1**, nos I, IIa and IIIa), not by *in situ* settlement features on the plateau of Wallersberg. On the promontory close to hot spot I, archaeological prospection lately has revealed a few settlement features; however, they do not date to the Middle Bronze Age, but to the Early La Tène period (**tab. 1**, no. 8). This is more than 1000 years later than the land-use activities indicated by ^{14}C dates of the adjacent colluvial hot spots I and II. The absence of a Middle Bronze Age settlement site, which could be temporally linked to the colluvial hot spots on the plateau, may be due to several reasons: (a) settlement features may have existed, but have been completely eroded over time; (b) Middle Bronze Age settlement activity took place elsewhere, e. g. in the adjacent valley, and settlers occasionally came up on the plateau to open the vegetation by fire e. g. for pastoralism or agriculture; or (c) the settlement has not yet been found.
From the beginning of the Urnfield Culture (13th century BC), human land use seems to have increased on the plateaus, as evidenced by three settlement sites (nos 6-7 in **fig. 1** and **tab. 1**). Moreover, no. 9 has not yet been radiocarbon-dated but was dated by means of ceramic typology and colluvial layers (nos IV and V). For the Hallstatt period (800-480 BC), we find few settlements in the valleys and on the plateaus. For the Early La Tène period (480-250 BC), our data so far show a higher number of settlements in the valleys than on the plateaus.

RESULTS AND CONCLUSIONS

For the first time, our preliminary investigations evidence Middle Bronze Age land use and Late Bronze Age settlement sites on the plateaus of a German Central Upland region. The impact on the landscape through this early rural occupation is clearly visible by the presence of colluvial layers and charcoal fragments, hinting at a large-scale clearance of vegetation by fire, subsequent soil erosion and changes in the vegetation composition.
Due to the limited data and the hitherto absence of Middle Bronze Age settlement sites on the plateaus, the results are currently non-conclusive. Consequently, at this time it cannot be clearly established whether the Middle Bronze Age opening of the landscape is ascribable to long-term land-use activities such as farming and herding around permanent settlements or rather to seasonal activities around temporary campsites – a constellation that may have been complementary between valleys and plateaus.
The possible economic pattern and its shifts through time will be further investigated in the course of our follow-up research project. The same applies to the question of settlement preferences over time, e. g. the increase of settlements on the plateaus compared to the valleys from the beginning of the Urnfield Culture, the rather marginal location of settlement sites on the promontories of the plateaus in the Hallstatt period, and the increase of settlements in the valleys in the Early La Tène period. Whether these shifts can be related to socio-economic or climatic factors, requires a larger data basis and future strong linkage of all our archae-

ological, pedological and palaeoecological proxies, which will be the focus of our ongoing investigations. Continuing our work, we hope to shed new light on developments and patterns of prehistoric settlement and land use in a rural landscape of the Northern Franconian Jura during the Metal Ages.

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Zusammenfassung / Summary / Résumé

Siedlungs- und Landschaftsgeschichte der Nördlichen Frankenalb zur Bronze- und Eisenzeit

Es wird zumeist davon ausgegangen, dass im deutschen Mittelgebirgsraum zur Bronze- und Eisenzeit (ca. 2100-30 v. Chr.) keine nennenswerte ländliche Besiedlung existierte, obwohl aus dieser Zeit in einigen Regionen archäologische Fundstellen wie befestigte Höhensiedlungen, Ritualorte und Grabhügel bekannt sind. Die Präsenz dieser Fundplätze wie auch die Zunahme von Indizien aus Geoarchiven, die einen Einfluss des Menschen auf die Landschaft seit dem Neolithikum belegen, waren für uns der Anlass, die Nördliche Frankenalb in Bayern für eine Modellstudie auszuwählen. Beispielhaft sollen hier erstmals bronze- und eisenzeitliche Siedlungsaktivitäten und der menschliche Einfluss auf eine Mittelgebirgslandschaft systematisch analysiert werden.

In diesem Artikel stellen wir erste Ergebnisse unserer seit 2013 durchgeführten, interdisziplinären Untersuchung des Einzugsgebiets der Weismain vor. Mittels einer Kombination von geoarchäologischen und archäologischen Feld- und Laboruntersuchungen an Tal- und Plateausiedlungen konnten Landnutzungs- und Siedlungsaktivitäten ab dem 16. Jahrhundert v. Chr. (Mittlere Bronzezeit) nachgewiesen werden, außerdem Anzeichen einer Veränderung der Vegetation sowie von Landnutzungsstrategien und Siedlungspräferenzen bis zum Ende der Eisenzeit. Das noch laufende Projekt konnte somit bereits zeigen, dass die Landnutzung im Untersuchungsgebiet und möglicherweise in weiteren Mittelgebirgsregionen früher begonnen hat und intensiver und vielfältiger war als bisher angenommen.

Settlement and Landscape History of the Northern Franconian Jura during the Bronze and Iron Ages
Although hillforts, ritual sites and burial mounds have been in existence in various regions, the German Central Uplands have largely been considered void of rural occupation during the Bronze and Iron Ages (approx. 2100-30 BC). The presence of these sites, combined with mounting evidence from geoarchives of human impact on the landscape since the Neolithic, has led us to investigate the settlement and landscape history of the Northern Franconian Jura in Bavaria as a model region for studying human activity in and impact on the German Central Uplands during the Metal Ages.
In this article, we present the first results of an interdisciplinary study of the Weismain river catchment undertaken since 2013. A combination of geoarchaeological and archaeological, on-site and off-site, field and lab investigations at both valley and plateau sites revealed evidence of human land use and settlement from the 16th century BC (Middle Bronze Age) onwards, with further emerging evidence of changing vegetation, land-use strategies and settlement preferences until the end of the Iron Age. While research is still ongoing, it may be concluded that in the study region, and possibly other parts of the German Central Uplands, land use had begun earlier and was more intense and varied than previously thought.

Habitats et paysages du Jura franconien septentrional à l'âge du Bronze et du Fer
Bien que des sites fortifiés, rituels et des tumulus aient existé dans diverses régions, le bas-plateau central allemand a été largement considéré comme dépourvu d'occupation rurale pendant les âges du Bronze et du Fer (environ 2100-30 av. J.-C.). La présence de ces sites, combinée aux preuves croissantes des écofacts liés à l'impact humain sur le paysage depuis le Néolithique, nous a amené à étudier l'histoire de la colonisation et du paysage du Jura franconien du Nord en Bavière comme région modèle pour l'étude de l'activité humaine et de l'impact sur le bas-plateau central allemand au cours de l'âge des métaux.
Dans cet article, nous présentons les premiers résultats d'une étude interdisciplinaire du bassin versant de la Weismain entreprise depuis 2013. Une combinaison d'études géoarchéologiques et archéologiques, intrasite comme hors site, sur le terrain et en laboratoire dans les vallées et les plateaux a révélé des preuves de l'utilisation des terres et de la colonisation par l'homme à partir du 16^{e} siècle av. J.-C. (âge du Bronze moyen), ainsi que de nouvelles preuves de l'évolution de la végétation, des stratégies d'utilisation des terres et des préférences de colonisation jusqu'à la fin de l'âge du Fer. Bien que les recherches soit toujours en cours, on peut conclure que dans la région d'étude, et éventuellement dans d'autres parties du bas-plateau central allemand, l'utilisation des terres avait commencé plus tôt et était plus intense et variée que ce qui avait été envisagé auparavant. Traduction: L. Bernard

Schlüsselwörter / Keywords / Mots clés

Bayern / Bronzezeit / Eisenzeit / Siedlungsarchäologie / Geoarchive / Landschaftsarchäologie
Bavaria / Bronze Age / Iron Age / settlement archaeology / geo archives / landscape archaeology
Bavière / âge du Bronze / âge du Fer / archéologie de l'habitat / archives pédologiques / archéologie du paysage

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