[Supplementary material]

New burial rites at the end of the Linearbandkeramik in south-west Slovakia

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OSM 1

Table S1. Human individuals from Vráble with anthropological information and radiocarbon dates.

ID	Trench	Object	Sex	Min age	Max age	Preservation	Burial goods	Pathology and observations	Lab-code	^{14}C yr BP	1-sigma	Material	Collagen (%)	Nitrogen content (%)	Carbon content (%)
G1/S14	14	145	M?	20	34	Fairly complete	-	Healed cranial trauma posteriorly on the parietals, Schmorl's node on 2nd and 3rd cervical vertebrae; perimortem fractured bones; signs of animal gnawing	Poz-87474	6060	35	Cranial bone	0.7	0.5	2.8
									Poz-87473	5960	40	Right rib	0.9	16.4	45
G2/S21	21	3	M	25	34	Fairly complete, partly disarticulated, crouched	1 ceramic vessel	Cranial porosity (esp. Occipital bone); perimortem fractured bones; signs of animal gnawing, especially upper part of the skeleton	KIA-52446	6060	24	Cranial bone	4.7		
									Poz-98358	6090	40	Rib	3.7	17.1	46.9
G3/S21	21	3	M?	25	34	Complete, crouched	1 ceramic vessel	Cribra orbitalia; dental calculus; perimortem fractured bones; signs of animal gnawing	Poz-98348	6000	40	Cranial bone	1.4	17.6	48.5
									KIA-52449	6119	25	Left rib	4.3		
G4/S21	21	3	U	3	6	Fairly complete, skull missing	-		Poz-98359	6170	40	Right tibia	2.8	17.7	48.2
G5/S21	21	3	M?	15	24	Fairly complete, disarticulated	-	Antemortem trauma or a cyst on the 1st proximal hand phalanx; fused cervical vertebrae (C2+C3) - possible case of Klippel-Feil syndrome; perimortem fractured bones; signs of animal gnawing	Poz-98350	6240	40	Rib	1.5	17.9	48.8
G6/S21	21	4	U	18	22	Complete, crouched	1 ceramic vessel, 1 obsidian bladelet	Perimortem fractured bones; signs of animal gnawing	Poz-98342	5920	40	Cranial bone	0.7	14.8	52
									KIA-52448	6119	25	Right fibula	1.7		
G7/S21	21	21	M	30	44	Complete, crouched	1 ceramic vessel, 1 rubbing stone, 1 adze, 2 flint blades, meat	Calculus, esp. On the rear teeth; perimortem fractured bones	Poz-98364	6080	40	Cranial bone	2.8	17	46.8
									KIA-52445	6044	25	Rib	6.6		
									Poz-98362	6030	40	Lamb	2.6	16.4	45.2
G8/S21	21	10	M	20	29	Complete, crouched	6 ceramic vessels, 1 flint blade	Badly healed fracture of the left clavicle, lateral side; calculus, esp. On the rear teeth; slight signs of hypoplasia on the front teeth (at the age of 0.5–3 years); cribra orbitalia; perimortem fractured bones; used front teeth as tools; squatting facets	Poz-98360	6150	40	Cranial bone	2.9	17.8	48.7
									KIA-52444	6155	20	Rib	7.3		
G9/S21	21	14	F	40	49	Complete, crouched	-	Calculus, esp. On the front teeth; signs of osteopenia/osteoporosis; perimortem fractured bones	KIA-52447	6081	25	Cranial bone	4.3		

									Poz-98352	6100	40	Rib	1.5	16.9	46.3
G10/S 21	21	16	U	15+		Partly preserved, disarticulated	likely 1 obsidian blade	Perimortem fractured bones	KIA-52450	6002	25	Cranial bone	1		
									Poz-98357	6050	40	Right humerus	1	16.7	45.8
G11/S 22	22	102	U	20	29	Fairly complete, disarticulated	-	Perimortem fractured bones	Poz-98366	5840	40	Ulna/radius	2.8	16.3	44.8
G12/S 23	23	203	F?	20	24	Fairly complete, skull missing	-	Fully healed fracture of the mid-shaft of tibia; antemortem fractured lumbar vertebra (spondylolysis); spina bifida; DJD signs on the vertebrae; perimortem fractured bones (esp. Forearms); without skull; squatting facets	Poz-98444	6080	40	Rib	3.6	17.6	46.6
G13/S 23	23	203	M	35	49	Fairly complete, skull missing	-	Healed fracture of the left clavicle; lytic circular lesions of unknown origin on two vertebrae; Schmorl's node; probably fractured and healed right MC5; squatting facets; skull and left hand missing	Poz-98369	6210	40	Rib	4.8	17.5	47.5
G14/S 21	21	19	U	4	6	Scatter of teeth and bones	possibly 1 ceramic vessel		Poz-98793	5840	35	Unspecified bone	0.04	0.5	4
I15/S2 1	21	1	M?	15	19	Only single bones which not necessarily belong together, scattered	-		Poz-98344	6150	40	Cranium	3.3	18.	49.3
									Poz-98345	6170	40	Left femur	3	18.1	49.4
									Poz-98349	6130	40	Mandible	1.4	18.2	49.9
I16/S2 3	23	203	U	18+		Only single bones which not necessarily belong together, scattered	-		Poz-98445	5870	40	Unspecified postcranial bone	1.3	12.9	37
									Poz-98449	6140	40	Right femur	3.6	18.5	50.3
I17/S2 3	23	209	U	18+		Only single bones which likely belong together, scattered	-	Perimortem fractured bones	Poz-98446	6180	40	Femur	1.8	17.2	47
									Poz-98447	6100	40	Unspecified postcranial bone	2.2	17.2	47.2
									Poz-98448	6090	40	Femur	2.2	16.9	46.8

I18/S21	21	3	U	18+		Only single bones which not necessarily belong together, scattered	-		KIA-52451	6166	24	Cranial bone	4.7		
									Poz-98346	6180	40	Right femur	3	16.8	42.4
									Poz-98347	6170	40	Right humerus	2.1	16.9	45.7
									Poz-98361	6100	40	Unspecified postcranial bone	2	18.3	50.3
I19/S10	10					Os frontale			KIA-52708	6075	35	Os frontale	9		

OSM 2. Assumptions and additional information regarding the model in Figure 6.

Where cranial and post-cranial bones of the same individual were dated, we assumed that the collagen in the cranial bones formed a few years earlier than that in the post-cranial bones (mostly ribs), and applied appropriate offsets to these results, before using the OxCal function Combine (Bronk Ramsey 2009) to estimate the date of death of the individual concerned. In the case of burial G7/S21, the radiocarbon date from the lamb bones interpreted as a food offering at the time of burial was assumed to date the burial exactly.

The anthropological analyses suggest that all bones in object S23/209 belong to one individual (I17/S23; OSM1). The same may be true for the human remains in object S21/1 (I15/S21) and those in the upper layers of object S21/3 (I18/S21) and S23/203 (I16/S23). In each case, we applied the OxCal function Combine to the respective dates, after allowing for differences in collagen formation times, to obtain a single estimated date of death for the individual concerned. In all three cases, the Acomb-Index is above the critical value, indicating that the calibrated radiocarbon dates are compatible with the interpretation that the bones in question are from a single individual.

In the objects S21/3 and S23/203, the nearly complete individuals on the bottom of the ditch can be differentiated stratigraphically from the single bones in the layers above.

We had no archaeological reason to split the dates of the human and animal remains in and around the ditches into different phases and therefore put all these dates into one 'ritual deposits' phase. The dates of death of the individuals dated were assumed to be a random sample from a continuous, uniform temporal distribution of burials, whose start and end dates are thereby estimated using OxCal's Boundary function. Furthermore, to test whether the decapitated burials in the big ditch represent a different phase to regular burials in a clearly crouched position, we treated these two groups as separate, potentially overlapping bounded phases within the overall 'ritual deposits' phase.

All other human bone dates, as well as the dates of three animal bones apparently associated with ritual activities, are included in the overall bounded phase for ritual deposits.

Five radiocarbon results given in OSM1 are omitted from the model, as they are incompatible with the relative chronology embodied in the model structure. These results (denoted by '?' in Figure 6) are mainly from bones yielding <1 per cent collagen, and/or disarticulated bones which could be intrusive; all the rejected results are apparently too recent.

We also modelled an alternative interpretation, that all the bones from ditch fills are derived from the irregular burials phase; both interpretations are permitted by the results (i.e. both models yield satisfactory OxCal dynamic indices of agreement (Amodel>60; Bronk Ramsey 2009).

G10/S21 appears to be slightly too recent for the irregular burial phase, which may be because it represents a different mortuary practice, or because its radiocarbon ages are unreliable (both dated bones yielded only 1 per cent collagen).

Meadows *et al.* (2019) used OxCal's Outlier_Model function to downweight or exclude radiocarbon results from Vráble animal bone samples with low collagen yields. Because the dated human remains are from the same depositional environment as animal bones from domestic contexts, we initially applied the same Outlier_Model parameters to the human bone results, and included them in the Meadows et al. chronological model of the Vráble settlements. However, the application of collagen-turnover time offsets for human bones disables the Outlier_Model function for these samples. For the sake of simplicity, we have modelled the human bone results without using the Outlier_Model function.

OSM 3. OxCal-Code for Figure 6.

```
Plot()
 {
  Sequence("ritual deposits")
  {
   Boundary("ritual deposits start");
   Phase("ritual deposits")
   {
    Sequence("regular burials")
    {
     Boundary("start regular burials");
     Phase("regular burials")
     {
      Combine("G2/S21")
      {
       R_Date("KIA-52446 cranium", 6060, 24)+N(15,5);
       R_Date("Poz-98358 rib", 6090, 40)+N(2,1);
      };
      R_Date("G3/S21 KIA-52449 rib",6078,21)+N(2,1);
      R_Date("G6/S21 KIA-52448 fibula", 6119, 25)+N(5,5);
      Combine("G7/S21")
      {
       R_Date("Poz-98364 cranium", 6080, 40)+N(20,5);
       R_Date("KIA-52445 rib", 6044, 25)+N(2,1);
       R_Date("Poz-98362 lamb",6030,40);
```

```
   };
   Combine("G8/S21")
   {
    R_Date("Poz-98360 cranium", 6150, 40)+U(10,5);
    R_Date("KIA-52444 rib", 6155, 20)+N(2,1);
   };
   Combine("G9/S21")
   {
    R_Date("KIA-52447 210964-1 cranium", 6081, 25)+U(5,15);
    R_Date("Poz-98352 rib", 6100, 40)+N(2,1);
   };
   KDE_Plot("regular burial KDE", )
   {
   };
   Interval("duration of regular burials");
  };
  Boundary("end regular burials");
 };
 Sequence("irregular burials")
 {
  Boundary("start irregular burials");
  Phase("headless individuals")
  {
   Phase("object 203")
   {
    R_Date("G12/S23 Poz-98444", 6080, 40)+N(2,1);
    R_Date("G13/S23 Poz-98369", 6210, 40)+N(2,1);
   };
   R_Date("G4/S21 Poz-98359", 6170, 40)+N(1,1);
   Phase("other bones in ditch fills")
   {
    Phase("obj.3 lower layer")
    {
     R_Date("G5/S21 Poz-98350 rib", 6240, 40)+U(1,3);
     R_Date("Poz-98351 animal bone", 6150, 40);
    };
    Combine("G10/S21")
    {
     Outlier();
     R_Date("KIA-52450 cranium", 6002, 25)+N(15,5);
     R_Date("Poz-98357 humerus", 6050, 40)+N(5,5);
    };
    Combine("I15/S21 adolescent")
    {
     R_Date("Poz-98344 L femur", 6170, 40)+N(2,1);
     R_Date("Poz-98345 cranium", 6150, 40)+N(2,1);
     R_Date("Poz-98349 mandible", 6130, 40)+N(2,1);
    };
    R_Date("I16/S23 Poz-98449 femur", 6140, 40)+N(10,5);
    Combine("I17/S23")
    {
     R_Date("Poz-98446 femur", 6180, 40)+N(10,5);
     R_Date("Poz-98447 indet bone", 6100, 40)+U(1,15);
     R_Date("Poz-98448 femur", 6090, 40)+N(10,5);
    };
    Combine("I18/S21")
    {
     R_Date("Poz-98346 R femur", 6180, 40)+N(10,5);
     R_Date("Poz-98347 R humerus", 6170, 40)+N(10,5);
     R_Date("KIA-52451 cranium", 6166, 24)+N(15,5);
     R_Date("Poz-98361 indet bone", 6100, 40)+U(1,15);
    };
   };
   KDE_Plot("irregular burial KDE", )
   {
   };
   Interval("Duration of irregular burials");
  };
  Boundary("end irregular burials");
 };
 Phase("animal bones")
 {
  R_Date("Poz-98354", 6140, 40);
  R_Combine("Obj. 18")
  {
```

```
    R_Date("Poz-98355", 6100, 40);
    R_Date("Poz-98356", 6070, 40);
   };
  };
  Phase("trench 10")
  {
   R_Date("KIA-52708 os frontale", 6075, 35);
  };
  Phase("trench 14")
  {
   Combine("G1/S14")
   {
    R_Date("Poz-87474 cranium", 6060, 35)+U(10,5);
    R_Date("Poz-87473 rib", 5960, 40)+N(2,1);
   };
  };
  KDE_Plot("ritual deposits KDE", )
  {
  };
  Phase("omitted results")
  {
   R_Date("G3/S21 Poz-98348 cranium", 6000, 40)
   {
    Outlier();
   };
   R_Date("G6/S21 Poz-98342 cranium", 5920, 40)
   {
    Outlier();
   };
   R_Date("G11/S22 Poz-98366", 5840, 40)
   {
    Outlier();
   };
   R_Date("G14/S21 Poz-98793 indet bone", 5840, 35)
   {
    Outlier();
   };
   R_Date("I16/S23 Poz-98445 indet", 5870, 40)
   {
    Outlier();
   };
  };
  Span("ritual deposits duration");
 };
 Boundary("ritual deposits end");
};
Page( );
Order("regular burial order")
{
 Date("=G8/S21");
 Date("=G6/S21 KIA-52448 fibula");
 Date("=G9/S21");
 Date("=G3/S21 KIA-52449 rib");
 Date("=G2/S21");
 Date("=G7/S21");
};
};
```

OSM 4. OxCal-Code for Figure 10.

```
Sequence("Nitra")
 {
  Boundary("Nitra_S");
  Phase("Nitra")
  {
   R_Date("OxA-24574", 6222, 37);
   R_Date("OxA-24575", 6226, 36);
   R_Date("OxA-24095", 6298, 33);
   R_Date("OxA-24576", 6196, 36);
   R_Date("OxA-24577", 6216, 36);
   R_Date("OxA-23793", 6221, 35);
   R_Date("OxA-24578", 6138, 34);
   R_Date("OxA-24579", 6317, 34);
   R_Date("OxA-24580", 6227, 35);
   R_Date("OxA-23794", 6219, 35);
```

```
  R_Date("OxA-24582", 6328, 36);
  KDE_Plot("Nitra dates",);
 };
 Boundary("Nitra_E");
};
Sequence("Vedrovice")
{
 Boundary("Vedrovice_S");
 Phase("Vedrovice")
 {
  R_Date("OxA-15363",6305,40);
  R_Date("OxA-16618",6251,39);
  R_Date("OxA-15367",6219,35);
  R_Date("OxA-16627",6220,36);
  R_Date("OxA-15425",6298,34);
  R_Date("OxA-15429",6268,37);
  R_Date("OxA-16617",6240,45);
  R_Date("OxA-16625",6195,35);
  R_Date("OxA-16619",6169,38);
  R_Date("OxA-15431",6224,36);
  R_Date("OxA-16624",6226,37);
  R_Date("OxA-15369",6216,36);
  R_Date("OxA-16622",6250,40);
  R_Date("OxA-15368",6146,34);
  R_Date("OxA-15426",6272,37);
  R_Date("OxA-16623",6297,38);
  R_Date("OxA-15365",6141,34);
  R_Date("OxA-15387",6160,35);
  R_Date("OxA-16626",6249,36);
  R_Date("OxA-16651",6164,35);
  R_Date("OxA-15386",6300,36);
  R_Date("OxA-15366",6159,35);
  R_Date("OxA-15388",6246,36);
  R_Date("OxA-16621",6244,40);
  R_Date("OxA-15384",6199,37);
  R_Date("OxA-15385",6332,37);
  R_Date("OxA-15428",6253,36);
  R_Date("OxA-16620",6289,37);
  R_Date("OxA-15370",6234,36);
  R_Date("OxA-16650",6299,35);
  R_Date("OxA-15424",6263,34);
  R_Date("OxA-15364",6182,35);
  R_Date("OxA-15131",6266,36);
  R_Date("OxA-15427",6280,38);
  R_Combine("107/82")
  {
   R_Date("OxA-16628",6125,37);
   R_Date("OxA-16629",6175,37);
  };
  R_Combine("48/77")
  {
   R_Date("OxA-16652",6248,35);
   R_Date("OxA-16653",6290,37);
  };
  R_Combine("50/77")
  {
   R_Date("OxA-15432",6108,36);
   R_Date("OxA-15433",6069,36);
  };
  R_Combine("90/80")
  {
   R_Date("OxA-15430",6407,37);
   R_Date("OxA-15362",6375,50);
  };
  KDE_Plot("Vedrovice dates",);
 };
 Boundary("Vedrovice_E");
};
Sequence("Schwetzingen")
{
 Boundary("Schwetzingen_S");
 Phase("Schwetzingen")
 {
  R_Date("OxA-23200, Stz-006", 6142, 37);
  R_Date("OxA-23201, Stz-021", 6228, 37);
```

```
  R_Date("OxA-23202, Stz-026", 6233, 37);
  R_Date("OxA-23203, Stz-037", 6133, 37);
  R_Date("OxA-23204, Stz-048", 6243, 38);
  R_Date("OxA-23205, Stz-129", 6162, 36);
  R_Date("OxA-23206, Stz-133", 6202, 36);
  R_Date("OxA-23207, Stz-145", 6183, 36);
  R_Date("OxA-23208, Stz-155", 6187, 37);
  R_Date("OxA-23209, Stz-200", 6208, 34);
  R_Date("OxA-23210, Stz-200", 6171, 35);
  R_Date("OxA-23211, Stz-220", 6141, 37);
  KDE_Plot("Schwetzingen dates",);
 };
 Boundary("Schwetzingen_E");
};
Sequence("Niederpöring")
{
 Boundary("Niederpöring_S");
 Phase("Niederpöring")
 {
  R_Date("MAMS-29288, Grab 1", 6142, 31);
  R_Date("MAMS-29291, Grab 2", 6096, 29);
  R_Date("MAMS-29289, Grab 3", 6151, 32);
  R_Date("MAMS-29292, Grab 4", 6182, 28);
  R_Date("MAMS-29290, Grab 5", 6112, 29);
  R_Date("MAMS-29293, Grab 6", 6194, 28);
  R_Date("MAMS-29294, Grab 7", 6158, 29);
  KDE_Plot("Niederpöring dates",);
 };
 Boundary("Niederpöring_E");
};
Sequence("Derenburg Meerenstieg II")
{
 Boundary("Derenburg_S");
 Phase("Derenburg")
 {
  R_Date("KIA-30399", 6101, 34);
  R_Date("KIA-30400", 6015, 35);
  R_Date("KIA-30403", 6257, 40);
  R_Date("KIA-30404", 6151, 27);
  R_Date("KIA-30402", 6141, 33);
  R_Date("KIA-30407", 6148, 33);
  R_Date("KIA-30401", 6147, 32);
  R_Date("KIA-30405", 6142, 34);
  R_Date("KIA-40331", 6109, 31);
  R_Date("KIA-40333", 6199, 33);
  R_Date("KIA-40330", 6045, 35);
  R_Date("KIA-40329", 6135, 25);
  R_Date("KIA-40334", 6063, 33);
  R_Date("KIA-40335", 6197, 31);
  R_Date("KIA-30406", 6068, 31);
  KDE_Plot("Derenburg dates",);
 };
 Boundary("Derenburg_E");
};
Sequence("Kleinhadersdorf")
{
 Boundary("Kleinhadersdorf_S");
 Phase("Kleinhadersdorf")
 {
  R_Date("vera-2171",6060,35);
  R_Date("oxa-22941",6214,32);
  R_Date("vera-2168",6130,45);
  R_Date("vera-2169",6015,45);
  R_Date("vera-2165",6030,45);
  R_Date("vera-2164",6120,40);
  R_Date("oxa-23220",6027,36);
  R_Date("oxa-22943",6118,32);
  R_Date("oxa-22937",6156,33);
  //R_Date("oxa-22942",5910,33);
  R_Date("vera-2173",6215,35);
  R_Date("OxA-22936",6228,34);
  R_Date("vera-2170",6135,35);
  R_Date("oxa-22939",6117,34);
  R_Date("vera-2172",6155,35);
  R_Date("oxa-22940",6215,32);
```

```
  R_Date("oxa-22938",6148,32);
  R_Date("vera-2167",6090,50);
  R_Date("vera-2166",6090,35);
  KDE_Plot("Kleinhadersdorf dates",);
 };
 Boundary("Kleinhadersdorf_E");
};
Sequence("Halberstadt Sonntagsfeld")
{
 Boundary("Halberstadt Sonntagsfeld S");
 Phase("Halberstadt Sonntagsfeld")
 {
  R_Date("KIA-40346", 6211, 32);
  R_Date("KIA-40341", 6080, 32);
  R_Date("KIA-40342", 6137, 35);
  R_Date("KIA-40344", 6081, 30);
  R_Date("KIA-40348", 6076, 34);
  R_Date("KIA-40349", 6211, 32);
  R_Date("KIA-40351", 6265, 30);
  R_Date("KIA-40343", 6144, 32);
  R_Date("KIA-40345", 6159, 30);
  R_Combine("HAL2")
  {
   R_Date("KIA-40350", 6130, 39);
   R_Date("KIA-30408", 6123, 35);
  };
  KDE_plot("Halberstadt Sonntagsfeld dates",);
 };
 Boundary("Halberstadt Sonntagsfeld E");
};
Sequence("Karsdorf")
{
 Boundary("Karsdorf S");
 Phase("Karsdorf")
 {
  R_Date("KIA-40359", 6168, 32);
  R_Date("KIA-40356", 6116, 30);
  R_Date("KIA-40357", 6100, 32);
  R_Date("KIA-40358", 6127, 31);
  R_Date("KIA-40360", 6142, 31);
  KDE_plot("Karsdorf dates",);
 };
 Boundary("Karsdorf E");
};
Sequence("Tiefenellern")
{
 Boundary("Tiefenellern_S");
 Phase("Tiefenellern")
 {
  R_Date("ETH-14977", 6250, 55);
  R_Date("ETH-14978", 6230, 55);
  R_Date(" ETH-14979", 6150, 60);
  R_Date("ETH-14980", 6245, 60);
  //R_Date("ETH-14981", 4660, 60);
  R_Date("ETH-14982", 6185, 60);
  //R_Date("ETH-14983", 4760, 55);
  //R_Date("ETH-14984", 6855, 60);
  R_Date(" ETH-14985", 6095, 60);
  R_Date("ETH-14986", 6155, 60);
  KDE_Plot("Tiefenellern dates",);
 };
 Boundary("Tiefenellern_E");
};
Sequence("Herxheim")
{
 Boundary("Herxheim_S");
 Phase("Herxheim")
 {
  R_Date("VERA-1826",6145,35);
  R_Date("VERA-1827",6165,40);
  R_Date("VERA-1828",6190,30);
  R_Date(„VERA-1830",6195,35);
  R_Date("Beta-287101", 6100, 40);
  R_Date("Beta-287098", 6110, 40);
  R_Date("Beta-287103", 6110, 40);
```

```
 R_Date("Beta-286312", 6110, 40);
 R_Date("Beta-287100", 6130, 40);
 R_Date("Beta-265223", 6170, 40);
 R_Date("ETH-39380", 6125, 35);
 R_Date("ETH-39373", 6130, 35);
 R_Date("ETH-39384", 6145, 35);
 R_Date("ETH-39370", 6155, 35);
 R_Date("ETH-39383", 6155, 35);
 R_Date("ETH-39372", 6165, 35);
 R_Date("ETH-39375", 6165, 35);
 R_Date("ETH-39377", 6165, 35);
 R_Date("ETH-39378", 6200, 35);
 R_Date("ETH-39374", 6220, 50);
 R_Date("ETH-39371", 6225, 35);
 R_Date("ETH-52161", 6196, 33);
 KDE_Plot("Herxheim dates");
 };
 Boundary("Herxheim_E");
};
Sequence("Schletz")
{
 Boundary("Schletz_S");
 Phase("Schletz")
 {
 R_Date("VERA-2014",6125,35);
 R_Date("ETH-14374",6145,55);
 R_Date("ETH-14373",6025,55);
 R_Date("VERA-2007",6175,35);
 R_Date("VERA-2008",6145,35);
 R_Date("VERA-2009",6055,35);
 R_Date("VERA-2010",6130,35);
 R_Date("VERA-2011",6100,35);
 R_Date("VERA-2012",6075,35);
 R_Date("VERA-2015",6160,35);
 R_Date("VERA-2017",6200,35);
 R_Date("VERA-2737",6175,30);
 R_Combine("ind. 4455")
 {
  R_Date("VERA-2020",6235,40);
  R_Date("VERA-2738",6205,30);
 };
 //R_Date("VERA-2016",6210,40);regular
 //R_Date("VERA-2441",6165,35);regular
 //R_Date("VERA-2198",6210,35);regular
 //R_Date("VERA-2019",6175,40);provenance unclear
 KDE_Plot("Schletz dates",);
 };
 Boundary("Schletz_E");
};
Sequence("Halberstadt")
{
 Boundary("Halberstadt_S");
 Phase("Halberstadt")
 {
 R_Combine("MAMS-23992/23993")
 {
  R_Date("MAMS-23992", 6134, 43);
  R_Date("MAMS-23993", 6122, 43);
 };
 R_Combine("MAMS-23988/23989")
 {
  R_Date("MAMS-23988", 6093, 42);
  R_Date("MAMS-23989", 6096, 42);
 };
 R_Combine("MAMS-23990/23991")
 {
  R_Date("MAMS-23990", 6141, 42);
  R_Date("MAMS-23991", 6183, 42);
 };
 KDE_Plot("Halberstadt dates",);
 };
 Boundary("Halberstadt_E");
};
Sequence("Kilianstädten")
{
```

```
 Boundary("Kilianstädten_S");
 Phase("Kilianstädten")
 {
  R_Date("MAMS-14993",6127,27);
  R_Date("MAMS-14994",6108,27);
  R_Date("MAMS-14992",6120,27);
  R_Date("MAMS-14991",6051,29);
  KDE_Plot("Kilianstädten dates",);
 };
 Boundary("Kilianstädten_E");
};
Sequence("Talheim")
{
 Boundary("Talheim_S");
 Phase("Talheim")
 {
  R_Date("Hd-8607-8828",6045,80);
  R_Date("VERA-2023",6085,30);
  R_Date("VERA-2046",6115,35);
  R_Date("VERA-2047",6140,40);
  R_Date("VERA-2025",6015,35);
  R_Date("VERA-2026",6095,35);
  R_Date("VERA-2021",5930,35);
  R_Date("VERA-2022",6130,35);
  KDE_Plot("Talheim dates",);
 };
 Boundary("Talheim_E");
};
{
 Sequence(„Vráble“)
 {
  Boundary("ritual deposits start");
  Phase("ritual deposits")
  {
   Sequence("regular burials")
   {
    Boundary("start regular burials");
    Phase("regular burials")
    {
     Combine("G2/S21")
     {
      R_Date("KIA-52446 cranium", 6060, 24)+N(15,5);
      R_Date("Poz-98358 rib", 6090, 40)+N(2,1);
     };
     R_Date("G3/S21 KIA-52449 rib",6078,21)+N(2,1);
     R_Date("G6/S21 KIA-52448 fibula", 6119, 25)+N(5,5);
     Combine("G7/S21")
     {
      R_Date("Poz-98364 cranium", 6080, 40)+N(20,5);
      R_Date("KIA-52445 rib", 6044, 25)+N(2,1);
      R_Date("Poz-98362 lamb",6030,40);
     };
     Combine("G8/S21")
     {
      R_Date("Poz-98360 cranium", 6150, 40)+U(10,5);
      R_Date("KIA-52444 rib", 6155, 20)+N(2,1);
     };
     Combine("G9/S21")
     {
      R_Date("KIA-52447 210964-1 cranium", 6081, 25)+U(5,15);
      R_Date("Poz-98352 rib", 6100, 40)+N(2,1);
     };
     KDE_Plot("regular burial KDE", )
     {
     };
     Interval("duration of regular burials");
    };
    Boundary("end regular burials");
   };
   Sequence("irregular burials")
   {
    Boundary("start irregular burials");
    Phase("headless individuals")
    {
     Phase("object 203")
```

```
   {
    R_Date("G12/S23 Poz-98444", 6080, 40)+N(2,1);
    R_Date("G13/S23 Poz-98369", 6210, 40)+N(2,1);
   };
   R_Date("G4/S21 Poz-98359", 6170, 40)+N(1,1);
   Phase("other bones in ditch fills")
   {
    Phase("obj.3 lower layer")
    {
     R_Date("G5/S21 Poz-98350 rib", 6240, 40)+U(1,3);
     R_Date("Poz-98351 animal bone", 6150, 40);
    };
    Combine("G10/S21")
    {
     Outlier();
     R_Date("KIA-52450 cranium", 6002, 25)+N(15,5);
     R_Date("Poz-98357 humerus", 6050, 40)+N(5,5);
    };
    Combine("I15/S21 adolescent")
    {
     R_Date("Poz-98344 L femur", 6170, 40)+N(2,1);
     R_Date("Poz-98345 cranium", 6150, 40)+N(2,1);
     R_Date("Poz-98349 mandible", 6130, 40)+N(2,1);
    };
    R_Date("I16/S23 Poz-98449 femur", 6140, 40)+N(10,5);
    Combine("I17/S23")
    {
     R_Date("Poz-98446 femur", 6180, 40)+N(10,5);
     R_Date("Poz-98447 indet bone", 6100, 40)+U(1,15);
     R_Date("Poz-98448 femur", 6090, 40)+N(10,5);
    };
    Combine("I18/S21")
    {
     R_Date("Poz-98346 R femur", 6180, 40)+N(10,5);
     R_Date("Poz-98347 R humerus", 6170, 40)+N(10,5);
     R_Date("KIA-52451 cranium", 6166, 24)+N(15,5);
     R_Date("Poz-98361 indet bone", 6100, 40)+U(1,15);
    };
   };
   KDE_Plot("irregular burial KDE", )
   {
   };
   Interval("Duration of irregular burials");
  };
  Boundary("end irregular burials");
 };
 Phase("animal bones")
 {
  R_Date("Poz-98354", 6140, 40);
  R_Combine("Obj. 18")
  {
   R_Date("Poz-98355", 6100, 40);
   R_Date("Poz-98356", 6070, 40);
  };
 };
 Phase("trench 10")
 {
  R_Date("KIA-52708 os frontale", 6075, 35);
 };
 Phase("trench 14")
 {
  Combine("G1/S14")
  {
   R_Date("Poz-87474 cranium", 6060, 35)+U(10,5);
   R_Date("Poz-87473 rib", 5960, 40)+N(2,1);
  };
 };
 KDE_Plot("ritual deposits KDE", )
 {
 };
 Phase("omitted results")
 {
  R_Date("G3/S21 Poz-98348 cranium", 6000, 40)
  {
   Outlier();
```

```
  };
  R_Date("G6/S21 Poz-98342 cranium", 5920, 40)
  {
   Outlier();
  };
  R_Date("G11/S22 Poz-98366", 5840, 40)
  {
   Outlier();
  };
  R_Date("G14/S21 Poz-98793 indet bone", 5840, 35)
  {
   Outlier();
  };
  R_Date("I16/S23 Poz-98445 indet", 5870, 40)
  {
   Outlier();
  };
 };
 Span("ritual deposits duration");
};
Boundary(„Vráble end");
};
```

OSM 5. Methods used for the anthropological evaluation of the skeletal remains from Vráble (by Zuzana Hukeľová).

The sex of individuals was estimated according to the morphological features on the skull and pelvis (Phenice 1969; Acsádi & Nemeskéri 1970; Rogers & Saunders 1994; Walker, in Buikstra & Ubelaker 1994; Graw *et al*. 1999; Brickley & McKinley 2004). Dimensions of the long bones were used as a complementary method (Dwight 1894; Thieme 1957; Black 1978; Stewart 1979; Symes & Jantz 1983).

In sub- adults, tooth eruption times were used as a key method for estimating the age at death (Ubelaker 1989). Additionally, lengths of the long bones were also used (Stloukal & Hanáková 1978; Fazekas & Kósa 1978), with the use of Buikstra and Ubelaker's (1994) scoring system. Times of epiphyseal fusion based on morphological summaries by Schaefer *et al*. (2009) were also taken into account when evaluating age at death of adolescent individuals. In adults, the age at death was established using following methods: level of dental wear (Brothwell 1981; Lovejoy 1985; Miles 2001) and morphology of the auricular surface of the ilium (Lovejoy *et al*. 1985; Buckberry & Chamberlain 2002), the pubic symphysis (Todd 1930; Meindl *et al*. 1985; Brooks & Suchey 1990), and the sternal ends of the ribs (Ïsçan *et al*. 1984a, 1984b, 1985; Ïsçan & Loth 1986; Yoder *et al*. 2001; Kurki 2005; DiGangi *et al*. 2009). Closure times of cranial sutures were not addressed, as the remains were very fragmented and sometimes poorly preserved. Moreover, this is one of the least accurate methods for age estimation (Falys & Lewis 2011). Dental wear is also perceived as rather inaccurate (ibid.); however, in the assemblage from Vráble it was often the only method that could be used. Pathologies and other abnormal lesions were assessed macroscopically.

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