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ISOTOPIC ANALYSIS OF FAUNAL REMAINS FROM NEANDERTHAL SITES IN CENTRAL AND SOUTHERN GERMANY

An outlook

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Introduction

As part of a study on Late Neanderthal prey species (set up since 2017 under the umbrella of CRC 806 „Our Way to Europe") and supported by an ongoing master thesis (Florian Gumboldt), isotopic analysis is performed on faunal remains from five Neanderthal sites in central and southern Germany (Fig. 1).

In order to elucidate particular Late Neanderthal contexts before the advent of modern humans, selection of sites and assemblages concentrated on the MIS 5c to MIS 3 time range, i.e., the early to mid Weichselian glacial. Here, sites at larger distance to one another and in different landscapes and geological settings have been selected (Fig. 2).

The goal of the master thesis is to examine the biographic mobility of the sampled individuals and to reconstruct their dietary and environmental conditions (by Sr, N, C and O isotope analysis) to draw conclusions about the living conditions of the latest Neanderthals in the investigated area. Furthermore, an innovative attempt is made to date the faunal remains by uranium-thorium dating to receive age estimates in comparison to and beyond the chronological limits of available radiocarbon dates.

This poster presents preliminary results on the measurements of the strontium isotopes and provides an outlook on the biographic mobility of the prey species.

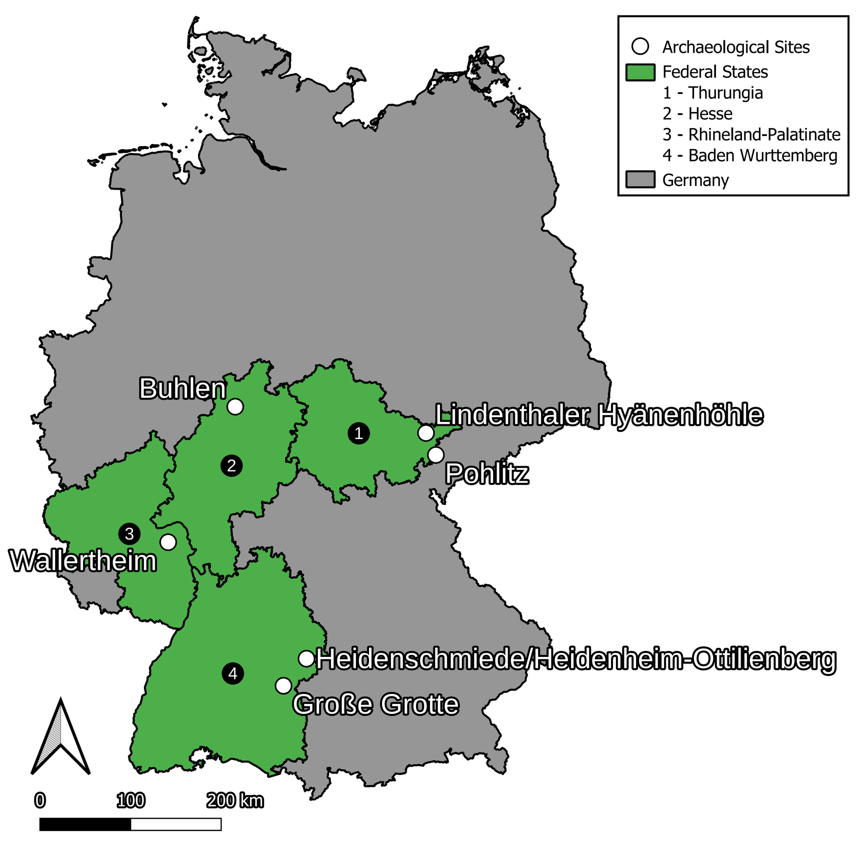

Fig. 1 Geographic position of the sampled Late Neanderthal sites in central and southern Germany as well as the location of the woolly rhino from Pohlitz, which was radiocarbon dated additionally.

Methods

In a first step of the ongoing master thesis, strontium and uranium-thorium isotope analysis were performed for ten individuals from Buhlen, Wallertheim, Lindenthaler Hyänenhöhle, Große Grotte and Heidenschmiede.

Methodically, we proceeded as follows (Fig. 3):

1. Selection and sampling
Sample selection and sampling were performed at the Institute of Geology and Mineralogy at the University of Cologne under the supervision of Stephanie Kusch.

2. Cleaning
The samples were cleaned with MilliQ in an ultrasonic bath for 15 minutes and rinsed with MilliQ three times to remove adherent contaminations.

3. Preparation
Sub-samples of the cleaned samples were grinded in an agate mortar. Then, 0.1 g uranium-thorium spike and 6 N HCl were added to 0.1 g sample. To dissolve the samples and equilibrate the spike, the samples were placed on a hotplate overnight and dried afterwards. Then, the samples were dissolved in c. HNO3 and H2O2 and were dried on a hotplate overnight. The step was repeated with c. HNO3. Both steps were used to remove organic residues.

4. Isotope separation
4.1 Uranium and thorium separation
The samples were dissolved in 7 N HNO3 and transferred to ion exchange columns with an anion exchange resin (AG1-X8 Resin, 100-200 mesh, BIO-RAD) and washed in with two reservoir volumes 7 N HNO3. The supernatants were collected and dried to be used in the strontium separation later. Thorium was eluted in six filter volumes 6 N HCl and uranium was eluted in three filter volumes 1 N HBr, respectively. Afterwards, the element cuts were dried and dissolved in 0.14 N HNO3 (uranium) and 0.2 N HCl/0.1 N HF (thorium) for mass spectrometry.

4.2 Strontium separation
The samples were dissolved in 2.5 N cal. HCl and transferred to ion exchange columns with a cation exchange resin (AG50W-X8 Resin, 200-400 mesh, BIO-RAD), which was loaded with 2.5 N cal. HCl. The samples were washed in with 2.5 N cal. HCl and the strontium was eluted in 2.5 N cal. HCl. Afterwards, the element cuts were dried and dissolved in 0.14 N HNO3/H2O2 for mass spectrometry.

5. Mass spectrometry
Mass spectrometry was performed on a Thermo Scientific Neptun Plus. As a control, several standards were measured beside the samples.

6. Processing
Data processing was performed by Carsten Münker.

Preliminary results

One goal of the master thesis is to determine the biographic mobility of Late Neanderthal prey species by strontium isotope analysis.

Strontium enters the food chain by weathering of bedrock followed by uptake to plants and water (Fig. 4). In this process, ratios 87Sr/86Sr does not change significantly and can be used to determine the biographic mobility. Strontium is built in tooth enamel instead of calcium when the tooth enamel is formed, where it reflects the environmental signal of childhood. As continuous process, strontium is also built in bone instead of calcium, where it reflects the environmental signal of the last month/years before death.

To give a first outlook, to the biographic mobility of the ten individuals sampled first, reference data of bioavailable strontium provided by Bentley and Knipper (2005) was used (Tab. 1). Six individuals (FG-1, 4-7, 9) fall into the range of loess and alluvial deposits as well as glacial moraines, one individual (FG-3) falls into the range of Jurassic limestone and three samples (FG-8, 10, 11) could not be assigned to the reference data. Except for two samples (FG-4, 5), all others within range of loess, alluvial deposits, and glacial moraines, consists of tooth enamel, which is more resistant to contaminations with environmental strontium than bones. With the necessary caution, the data indicates that the individuals have spent their childhood in lowland areas with Pleistocene deposits. Bone, however, is more vulnerable for contaminations with environmental strontium, which thus could have influenced the results of samples FG-4, FG-5, and FG-6. If contamination can be excluded, the data indicates a stay in lowland areas with Pleistocene deposits (FG-4, 5) and upland areas with Jurassic limestone (FG-6) which fits to the environment of the Heidenschmiede.

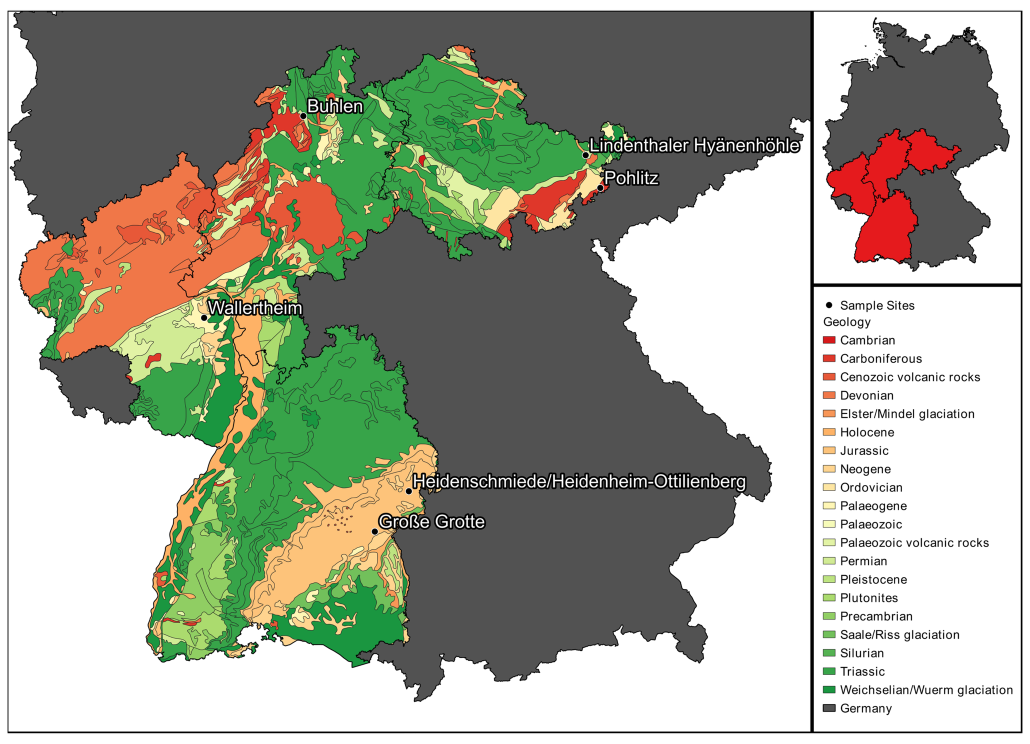

Fig. 2 Geology around the sampled Late Neanderthal sites in central and southern Germany as well as the location of the woolly rhino from Pohlitz, which was radiocarbon dated additionally (modified after GK2000).

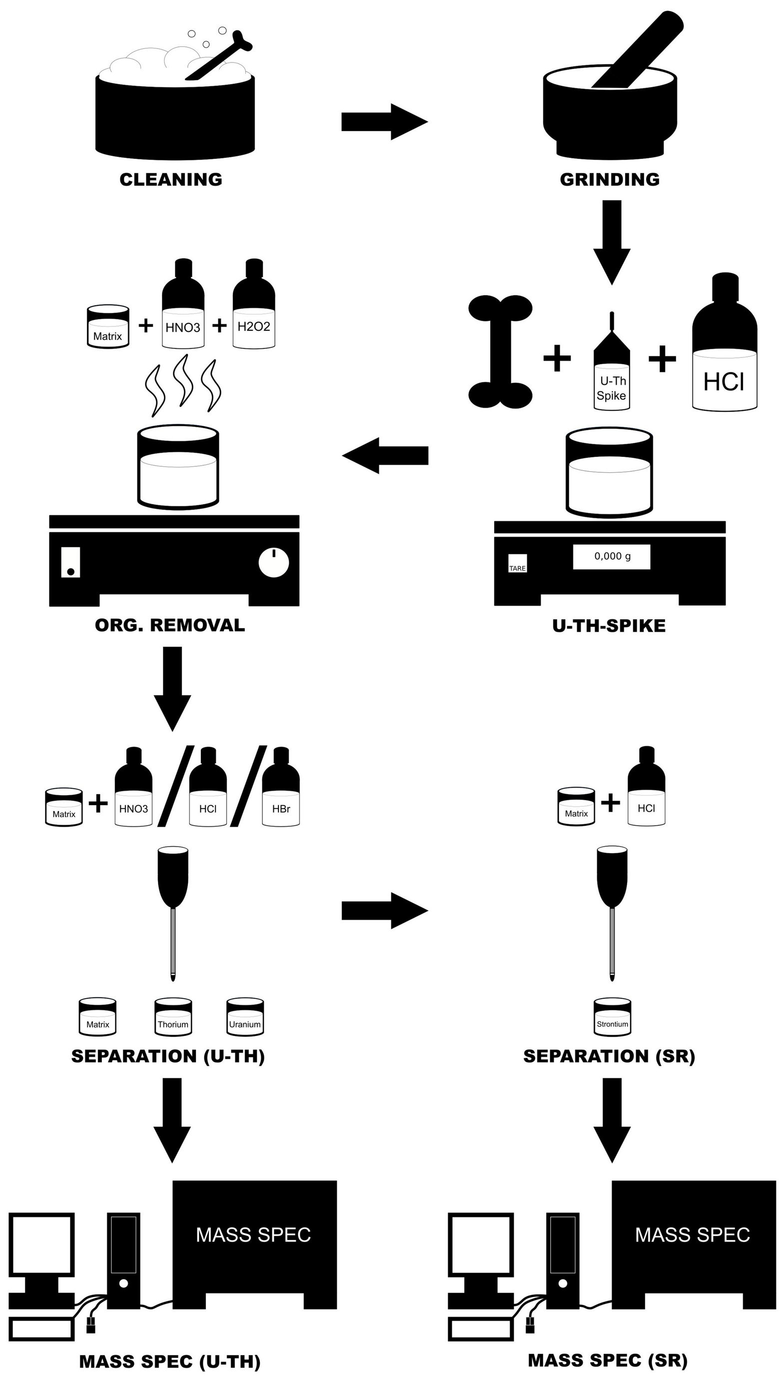

Fig. 3 Applied methods for strontium and uranium-thorium isotope analysis.

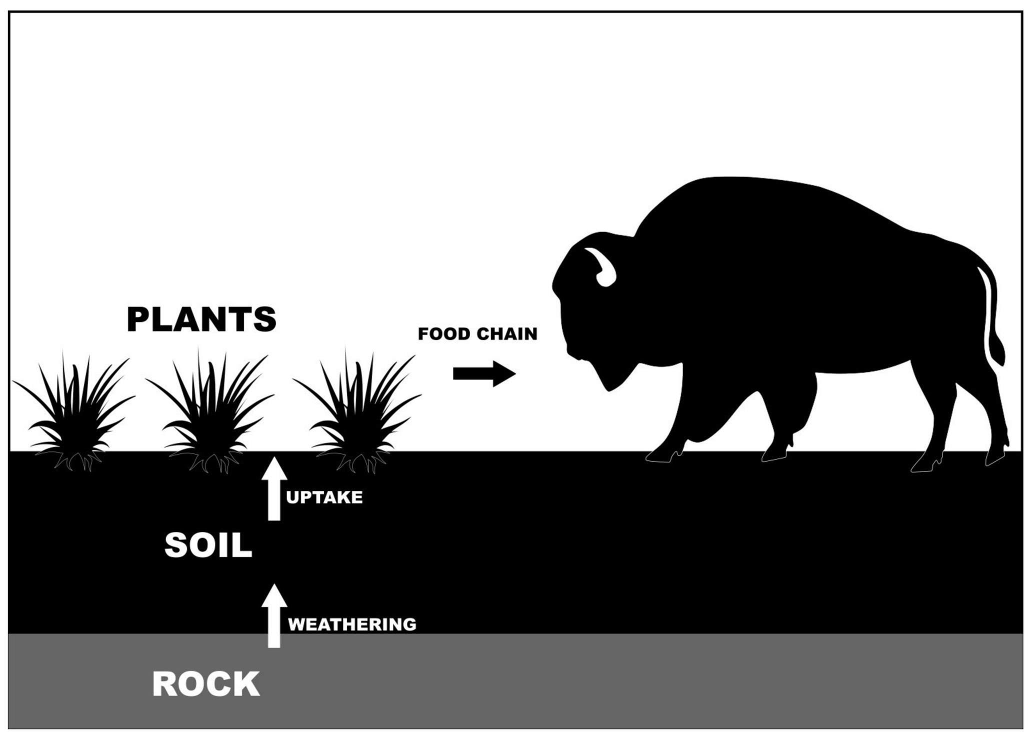

Fig. 4 Strontium cycle. Strontium enters the food chain by weathering of bedrock followed by uptake to plants and water.

Two sub-samples of KA-EQ G7 were used to determine the effect of the cleaning step for the strontium isotope analysis. The dirty sub-sample (FG-2) was more radiogenic than the cleaned sample (FG-1) which could indicate adherent contaminations that were removed during cleaning.

The measurements of uranium-thorium isotopes for the ten individuals are finished, but the data processing must be performed.

Outlook

This poster presents the applied methods and preliminary results of an ongoing master thesis.

Future work will be the processing of the uranium-thorium data, further strontium and uranium-thorium analysis, the expansion of the reference database for bioavailable strontium from literature, the analysis of stable isotopes and the interpretation of the data to examine the biographic mobility of the sampled individuals and to reconstruct their dietary and environmental conditions to draw conclusions about the living conditions of the latest Neanderthals in the investigated area.

Acknowledgments

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Lab. No.	Sample	$^{87}Sr/^{86}Sr$	Material	Fauna	Sample site	CD	CD	CD
FG1	KA-EQ-G7	0,709971	Tooth (Enamel)	Horse	Buhlen			
FG2	KA-EQ-G7*	0,710104	Tooth (Enamel)	Horse	Buhlen			
FG3	HDH-CO-A1	0,708333	Bone	Wolly Rhino	Heidenschmiede			
FG4	MZ-BI-H8	0,709951	Bone	Bison	Wallertheim			
FG5	ST-RA-I9	0,709337	Bone	Reindeer	Große Grotte			
FG6	HDH-EQ-M13	0,708895	Tooth (Enamel)	Horse	Heidenschmiede			
FG7	MZ-BI-C3	0,709966	Tooth (Enamel)	Bison	Wallertheim			
FG8	GA-EQ-A1	0,711831	Tooth (Enamel)	Horse	Lindenthaler Hyänenhöhle			
FG9	KA-CO-O15	0,710035	Tooth (Enamel)	Wolly Rhino	Buhlen			
FG10	GA-EQ-F6	0,711398	Bone	Horse	Lindenthaler Hyänenhöhle			
FG11	GA-CO-AI34	0,711682	Bone	Wolly Rhino	Lindenthaler Hyänenhöhle			

Comparative Data** (CD):
Rhine, Main, Neckar, Pre-Alpine Lowlands (Loess and Alluvial deposits) = 0,7086 - 0,7103
Black Forest and Voges (Granites/Granodiorites/Metamorphic Rocks) = 0,713 - 0,719
Black Forest and Voges (Water) = 0,714 - 0,725
Bavarian Forest (Granites and Gneisses) = 0,7202
Hegau (Volcanic Bedrock) = 0,738 - 0,746
Hegau (Glacial Moraines) = 0,709 - 0,710
Swabian Jura (Heidengraben) = 0,7097 - 0,7098
Swabian Jura (Jurassic Limestone) = 0,707 - 0,7086

*dirty
**Bentley and Knipper 2005

Tab. 1 Strontium isotope values from 10 individuals (Late Neanderthal prey species) compared to reference data of bioavailable strontium provided by Bentley and Knipper (2005).

R. A. Bentley/C. Knipper. Geographical patterns in biologically available strontium, carbon and oxygen isotope signatures in prehistoric SW Germany. Archaeometry 47 (3), 2005, 629-644.

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