

Supplementary Material

Gradient analysis of relationships between soil, decomposition of human remains, and external factors in graves in four Norwegian municipalities

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Supplementary material 1

Variables in the dataset

Table 1 All variables in the dataset, before removing variables. OF = Ordered factor variable, B = Binary factor variable, C = Continuous variable. Question 22 (was decomposition evaluated?) and 26 (can the grave be reused?) were not analyzed, as all observations were answered with “yes” for the graves with decomposition evaluation. All blank answers were treated as NA. Color spots from weathered stone, as well as pockets of mixed-in material were excluded so that the factors “Redox” should best represent oxidation/reduction of iron (Fe) in soil

Classification of variable	Variable explanation/ survey question	Abbreviation	Type	Number of possibilities per FV	Question number	Comment	Included in final dataset
Response	Decomposition of coffin	Coffin	OF	6	18	Response variable	Yes
Response	Decomposition of skeleton	Skeleton	OF	6	19	Response variable	Yes
Response	Decomposition of soft body parts	Soft Parts	OF	6	21	Response variable	Yes
Response	Decomposition of textiles	Textiles	OF	6	20	Response variable	Yes
Locality	Municipality	Mun	F	-	-		Yes
Cemetery management	Number of previous burials	NoPrevBurial	OF	3	2		Yes
Cemetery management	Year of the last burial	Age	C	-	3	Year of previous burial – year of observation (reuse)	No (NA=20)
Cemetery management	Grave type	GraveT	B	2	4	Double/Single	Yes
Cemetery management	Grave depth in cm	GraveD	C	-	5		Yes
Cemetery management	Influenced by extra irrigation?	Irrigation	B	2	7	Yes/No Unknown=NA	Yes
Cemetery management	Soil replacement/soil translocation of the cemetery field?	SoilTransl	B	2	8a	Yes/No Unknown=NA	No (n ₁ =4)
Plastic-grave properties	Plastic present in the grave?	Plastic	B	2	25	Yes/No	Yes
Plastic-grave properties	Grave treated with lime?	Lime	B	2	24	Yes/No	Yes
Soil properties	Horizon boundaries of the whole profile	HBWhole	OF	3	9	Sharpness of boundaries	Yes
Soil properties	Horizon boundaries of subsoil	HBLow	OF	3	14	Sharpness of boundaries	Yes
Soil properties	Depth of root growth	RootDepth	C	-	13		No (NA=23)
Soil properties	Basic color in the upper horizon (upper subsoil)	ColorUpper	OF	6	11		Yes
Soil properties	Basic color in the lower horizon (lower subsoil)	ColorLow	OF	6	16		Yes
Soil properties	Mineral vs. organic soil/organic rich	OM	F	2	8b	Mineral=0/Organic=1	Yes

Table 1 Continued

Classification of variable	Variable	Abbreviation	Type	Number of possibilities per FV	Question number	Comment	Included in final dataset
Soil properties	Sorting of texture in the upper horizon, above coffin	MorA	F	2	10	Unsorted material (moraine) and sorted (clay, silt, sorted sand and gravel, stones, rock). Yes=1/No=0	Yes
Soil properties	Sorting of texture in the lower horizon, coffin depth	MorCD	F	2	15	Unsorted material (moraine) and sorted (clay, silt, sorted sand and gravel, stones, rock). Yes=1/No=0 Other=NA	Yes
Soil properties	Soil texture of the upper horizon, above coffin*	TexA	OF	3	10	Clay (1); silt (2); sand/gravel, stones, rock/moraine (3) See ¹	Yes
Soil properties	Soil texture of the lower horizon, coffin depth	TexCD	OF	3	15	Clay (1); silt (2); sand/gravel, stones, rock/moraine (3). See ¹	Yes
Water properties	Groundwater observed?	Groundwater	B	2	6	Yes/No	Yes
Water properties	Grave within the drip zone of trees	DripZone	B	2	23	Yes/No	Yes
Water properties	Redoximorphic features, “mottling”, in the upper horizon, above coffin	RedoxA	F	2	12	None (No=0)/Different colors (Yes=1). See ²	Yes
Water properties	Redoximorphic features, “mottling”, in the lower horizon, coffin depth	RedoxCD	F	2	17	Yes=1/No=0. See ²	Yes

¹Norwegian moraine soils, from experience, are most often classified as having a sandy loam texture. The answer of “moraine”, in a texture setting, was thus placed in a group with the alternatives of sand, plus the observations of gravel/stone/rock, giving the variable alternative of “sand”, a group of soils of coarser textures of sand, sandy loam, loamy sand, and loam with max 10% clay content. The threshold of 10% clay content, in addition to the threshold of max 12% clay content in silty soils, is in accordance with Norwegian soil texture classification (Figure 1) (Sveistrup, 1984), for young, weakly weathered soil.

²Color spots from weathered stone, as well as pockets of mixed-in material were excluded so that the factors “Redoximorphic features” should best represent oxidation/reduction of iron (Fe) in soil.

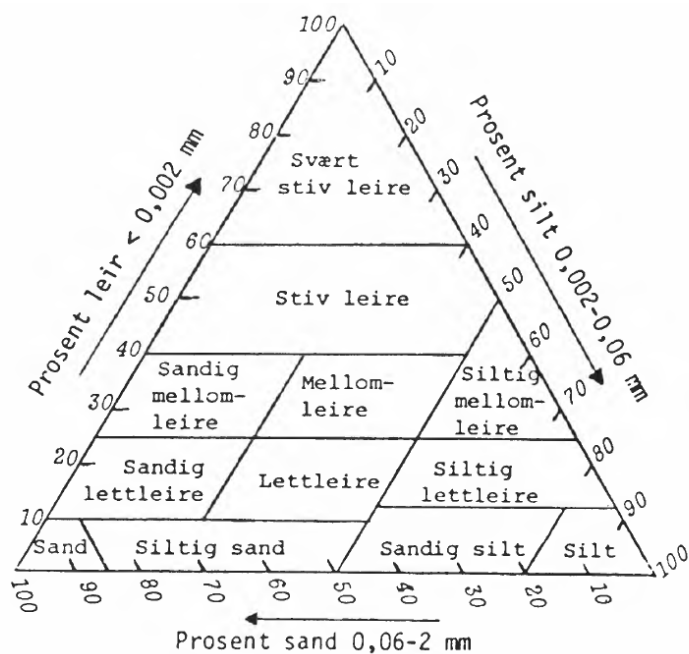


Fig. 1 Soil texture triangle for Norwegian soils, adapted to fit young, unweathered to weakly weathered soils. From Sveistrup & Njøs, (1984).
Reference:
Sveistrup, T.E. & Njøs, A. (1984). Kornstørrelsesgrupper I mineraljord. Revidert forslag til klassifisering. *Jord og myr* 1, 8-14.

All ordered factor variables

Table 2 All ordered factor variables with an explanation of each level (rang). Modified from Økland *et al.* (2022)

Ordered factor variables	1	2	3	4	5	6	NA
<i>Coffin</i>	Very Bad	Bad	Moderately Bad	Moderately Good	Good	Very good	-
<i>Skeleton</i>	Very Bad	Bad	Moderately Bad	Moderately Good	Good	Very good	-
<i>Soft_Parts</i>	Very Bad	Bad	Moderately Bad	Moderately Good	Good	Very good	-
<i>Textiles</i>	Very Bad	Bad	Moderately Bad	Moderately Good	Good	Very good	-
<i>NoPrevBurial</i>	1	2	4, several, unknown				Unknown
<i>HBWhole</i>	Sharp	Gradual	None	-	-	-	-
<i>HBLow</i>	Sharp	Gradual	None	-	-	-	-
<i>ColorUpper</i>	Gray/blue gray, Gray/blue with yellow, Gray with red	Olive gray, Olive gray/yellow	Light brown	Reddish brown	Brown	Dark brown	-
<i>ColorLow</i>	Gray/blue gray, Gray/blue with yellow, Gray with red	Olive gray, Olive gray/yellow	Light brown	Reddish brown	Brown	Dark brown	-
<i>TexA</i>	Clay	Silt: silt loam, silt; max 12% clay	Sand: sand, sandy loam, loamy sand, loam; max 10% clay ¹	-	-	-	-
<i>TexCD</i>	Clay	Silt: silt loam, silt; max 12% clay	Sand: sand, sandy loam, loamy sand, loam; max 10% clay ¹	-	-	-	Unknown

¹Norwegian moraine soils, from experience, are most often classified as sandy loam texture. The answer of “moraine”, in a texture setting, was thus placed in a group with the alternatives of sand, plus the observations of gravel/stone/rock, giving the variable alternative of “sand”, a group of soils of coarser textures of sand, sandy loam, loamy sand, and loam with max 10% clay content. The threshold of 10% clay content, in addition to the threshold of max 12% clay content in silty soils, is in accordance with Norwegian soil classification (Sveinstrup, 1984), for young, weakly weathered soil (see Figure 1).

Supplementary material 2

Inferring values for missing entries

In some instances where only a few observations were missing, NA was inferred to the most likely value based on properties of the variable across the sample sets. This choice was made to preserve the overall data set strength of 61 observation units (graves) and include as many predictor variables as possible, while minimizing the effect of these inferred values on the results. For factor variables with categorical variable names, 0 and 1 replaced the names, with the most common observation set to 0. “no”, “mineral”, and “single” was set to 0. “yes”, “organic”, and “double” was set to 1.

Table 1 Inferred values of missing data in the predictor variables

Variable	Types of NA	# of NA	Change	Comment
<i>NoPrevBurial</i>	NA	6	Changed to most common observation, “1”	Grave depths were more than 100 cm, and thus they likely didn’t have to put the coffin above a previously buried coffin
<i>GraveD</i> <i>Irrigation</i>	NA	4	From the 57 observations	
	“Unknown”	2	Changed to most common observation, “no”	
<i>Plastic</i>	NA	1	Changed to most common observation, “no”	
<i>Lime</i>	Na, “Unknown”	2	Changed to most common observation, “no”	
<i>OM</i>	NA	8	Changed to most common observation, “mineral soil”/OM_poor	Kept because it was the only variable giving information on organic matter content
<i>TexCD</i>	NA	1	Set to the same value as observed in the related predictor variable <i>TexA</i> for the affected sample units	
<i>Groundwater</i>	“Unknown”	1	Changed to most common observation, “no”	
<i>RedoxA</i>	NA	3	Set to the same value as observed in the related predictor variable <i>RedoxCD</i> for the affected sample units	
<i>RedoxCD</i>	NA	1	Changed to most common observation, “no”	

Supplementary material 3

Comparison of the two GNMDS solutions with lowest stress

2D GNMDS, with 2000 starting configurations and 2000 iterations, had best and second-best solutions with the same stress value and significant similarity in the Procrustes Sum of Squares and protest (Table 1). The Procrustes error plot (Figure 1) showed no shift in point configuration between the two solutions. With identical best and second-best solutions, the risk of being caught in a local minimum stress value was low.

Table 1 Stress values and Procrustes tests for the best and second-best solutions of 2D GNMDS

2D GNMDS	
<i>Stress value best</i>	0.06623592
<i># iterations best</i>	92
<i>Stress value second best</i>	0.06623592
<i># iterations s. best</i>	63
<i>Procrustes SS</i>	3.305e-08
<i>Protest Procrustes SS</i>	2.984e-09
<i>Procrustes correlation coefficient (r)</i>	1
<i>Monte Carlo Significance p</i>	0.001
<i>Number of permutations</i>	999

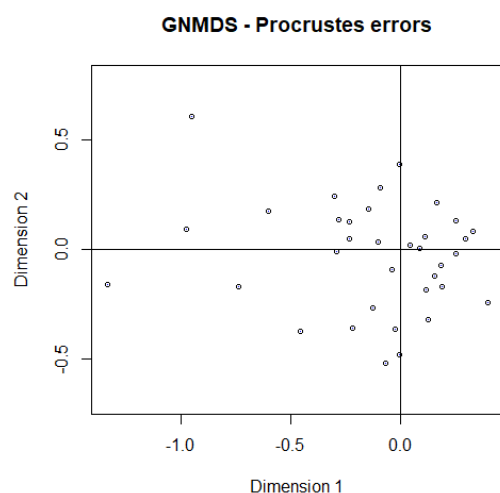


Fig. 1 Procrustes errors for 2D GNMDS of the best and second-best solutions

Supplementary material 4

Comparison of PCA and GNMDS ordinations

Table 1 Kendall's rank correlation coefficients τ between all PCA and GNMDS axes (p -values significant at the $\alpha = 0.05$ level in **bold**), negative correlations in *italics*

Axis	PCA1		PCA2		PCA3		PCA4	
	τ	p	τ	p	τ	p	τ	p
GNMDS1	0.8513	<0.0001	-0.0301	0.7358	0.0457	0.6171	-0.3200	0.0005
GNMDS2	-0.1435	0.1135	0.8562	<0.0001	0.0376	0.6785	-0.0102	0.9100

In addition to the highly correlated pairwise axes of GNMDS and PCA described in the article, a weaker significant negative correlation existed between GNMDS1 and PCA4. This was attributed to random variation in the data.

The Procrustes tests of similarity between the PCA and GNMDS ordinations revealed a significant similarity and high correlation coefficient, although the solutions were not identical (Table 2, Figure 1). A comparison between the axes in an ordination also showed a high similarity between axes of like numbers. Based on the correlation analyses, Procrustes tests, and ordination of the PCA and GNMDS axes, the two ordination methods had produced axes of high correlation and similarity.

Table 2 Procrustes tests of similarity between PCA and GNMDS ordinations

	Procrustes SS	Protest Procrustes SS (m12 squared)	Correlation in a symmetric Procrustes rotation	Significance p	Number of permutations
Axis 1 & 2 PCA and 2D GNMDS	3.076	0.09929	0.9491	0.001	999

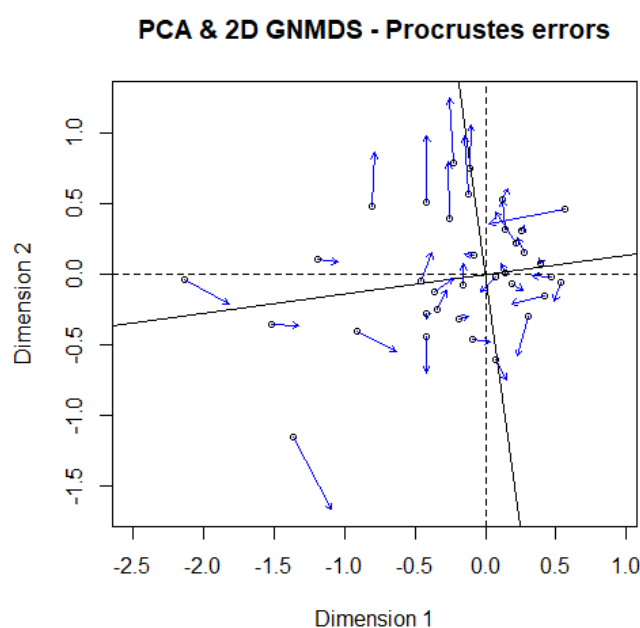


Fig. 1 Procrustes error plot of comparison between PCA and 2D GNMDS

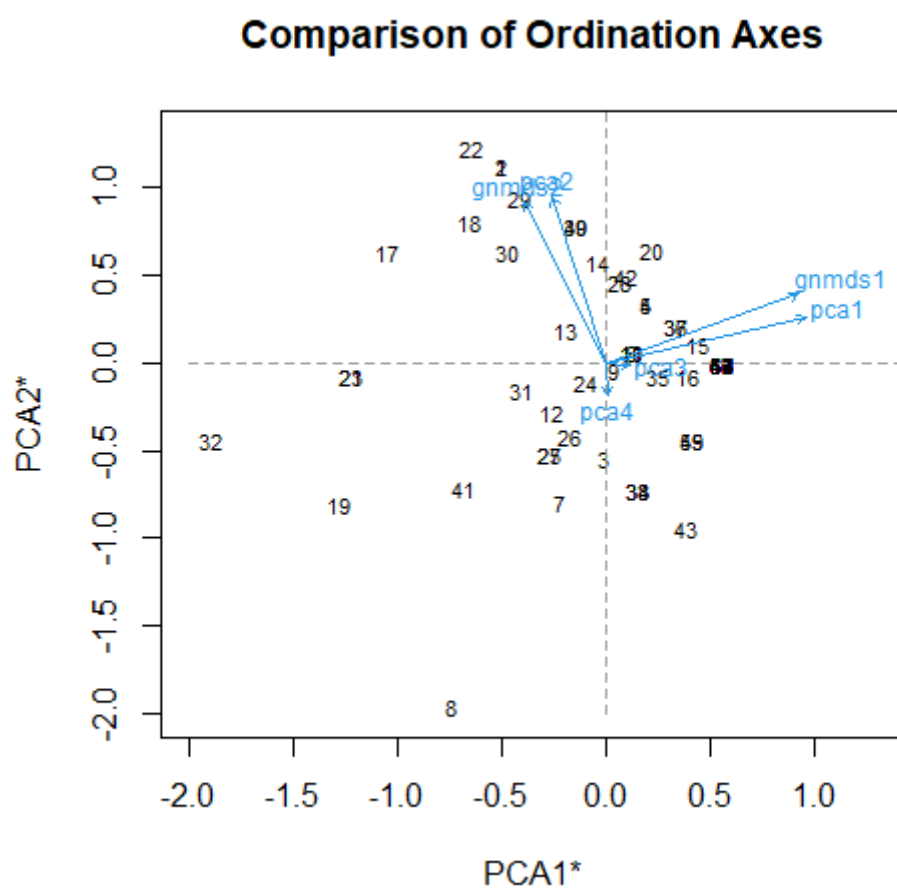


Fig. 2 PCA ordination of the PCA and GNMDS ordination axes, to compare the similarity of the axes of the two ordination methods. * Marks the axes of this secondary ordination, to distinguish them from the original PCA1 and PCA2 axes

Table 2 Eigenvalue and proportion explained for the PCA ordination of the PCA and GNMDS axes

	PCA1*	PCA2*	PCA3*	PCA4*	PCA5*	PCA6*
<i>Eigenvalue</i>	1.9945	1.9891	1.0000	1.0000	0.010882	0.0054678
<i>Proportion explained</i>	0.3324	0.3315	0.1667	0.1667	0.001814	0.0009113
<i>Cumulative Proportion</i>	0.3324	0.6639	0.8306	0.9973	0.999089	1.0000000

Supplementary material 5

PCA3, PCA4, and GNMDS correlation analyses with predictor variables

Table 1 Kruskal-Wallis' test of median differences in PCA axis scores between municipalities. Separate tests were made for PCA axes 1 and 2. *p*-values significant at the $\alpha = 0.05$ level in **bold**

Axis	Bergen	Bærum	Stavanger	Trondheim	<i>p</i>
PCA3	0.0381	0.0381	0.0381	0.2341	0.5666
PCA4	-0.2440	0.2314	-0.2440	0.0040	0.0314

Table 2 Kendall's Tau correlation τ of PCA axes 3 and 4 with response and predictor continuous and ranked factor variables. **Bold:** *p*-values of statistical significance, $\alpha = 0.05$, with four decimals. *Italic:* Negative significance, opposite correlation of ordination axes and variables

Variable	PCA3		PCA4	
	τ	<i>p</i>	τ	<i>p</i>
Coffin	0.1779	0.0754	-0.2689	0.0091
Skeleton	-0.4287	<0.0001	-0.1080	0.2887
Soft_Parts	0.0475	0.6518	0.3221	0.0022
Textile	-0.0253	0.8045	-0.2960	0.0037
NoPrevBurial	0.0315	0.7626	-0.1633	0.1173
GraveD	-0.0382	0.6882	-0.1645	0.0843
HBWhole	0.2405	0.0204	0.0600	0.5633
HBLow	0.1696	0.1048	0.2605	0.0127
ColorUpper	0.0716	0.4754	0.1233	0.2190
ColorLow	0.1172	0.2419	0.0026	0.9790
TexA	0.0316	0.7642	-0.0190	0.8572
TexCD	0.0334	0.7507	0.0628	0.5495

Table 3 Wilcoxon-Mann-Whitney unpaired two-sample tests of differences in the state 0 and 1 of binary predictor variables along PCA axes 3 and 4. **Bold:** *p*-values of statistical significance, $\alpha = 0.05$, with four decimals. *Italic:* Negative significance, opposite correlation of ordination axes and variables

Variable	PCA3			PCA4		
	median		<i>p</i>	median		<i>p</i>
	State 0	State 1		State 0	State 1	
GraveT	0.04	0.04	0.8595	-0.16	-0.24	0.3160
Irrigation	0.04	0.06	0.7752	-0.23	0.23	0.5975
Plastic	0.04	0.35	0.1783	-0.24	-0.00	0.3364
Lime	0.04	0.10	0.7118	-0.24	-0.00	0.1567
OM	0.04	0.04	0.4473	-0.08	-0.24	0.0836
MorA	0.04	0.04	0.8203	-0.14	-0.24	0.0635
MorCD	0.04	0.04	0.8189	-0.14	-0.24	0.0490
Groundwater	0.04	-0.12	0.1117	-0.20	-0.24	0.7975
DripZone	0.04	0.06	0.8694	-0.23	-0.16	0.6096
RedoxA	0.04	-0.10	0.1405	-0.16	-0.24	0.0903
RedoxCD	0.04	-0.10	0.1930	-0.20	-0.24	0.1502

Table 4 Kruskal-Wallis' test of median differences in PCA axis scores between municipalities. Separate tests were made for PCA axes 1 and 2. *p*-values significant at the $\alpha = 0.05$ level in **bold**

Axis	Bergen	Bærum	Stavanger	Trondheim	<i>p</i>
GNMDS1	0.3275	-0.1380	0.1530	-0.0154	0.0002
GNMDS2	-0.0811	-0.1274	-0.0811	0.1572	0.0029

Table 5 Kendall's Tau correlation between 2D GNMDS axes and response and predictor continuous and ranked factor variables. **Bold:** p-values of statistical significance, $\alpha = 0.05$, with four decimals. *Italic:* Negative significance, opposite correlation of response and predictor variables

Variable	GNMDS1		GNMDS2	
	τ	<i>p</i>	τ	<i>p</i>
Coffin	0.6025	<0.0001	-0.4754	<0.0001
Skeleton	0.5351	<0.0001	-0.3428	0.0006
Soft_Parts	0.4716	<0.0001	0.1685	0.1014
Textile	0.7218	<0.0001	0.2633	0.0083
NoPrevBurial	0.1286	0.2105	-0.1062	0.2969
GraveD	0.3287	0.0005	-0.1333	0.1524
HBWhole	-0.0669	0.5184	-0.0838	0.4107
HBLow	-0.1635	0.1172	-0.0591	0.5652
ColorUpper	-0.0278	0.7814	-0.0807	0.4127
ColorLow	0.1268	0.2046	-0.0250	0.7993
TexA	0.3043	0.0038	0.1031	0.3190
TexCD	0.2361	0.0242	0.1247	0.2265

Table 6 Wilcoxon-Mann-Whitney unpaired two-sample tests of the difference in GNMDS axis scores between medians for the states 0 and 1 of binary variables. **Bold:** p-values of statistical significance, $\alpha = 0.05$, with four decimals. *Italic:* Negative significance, opposite correlation of response and predictor variables

Variable	GNMDS1			GNMDS2		
	median		<i>p</i>	median		<i>p</i>
	State 0	State 1		State 0	State 1	
GraveT	0.09	0.16	0.8838	-0.06	-0.08	0.5014
Irrigation	0.16	-0.19	0.0007	-0.05	-0.13	0.1205
Plastic	0.15	-0.05	0.2603	-0.08	0.28	0.0038
Lime	0.13	-0.03	0.4215	-0.08	0.32	0.0009
OM	-0.00	0.31	0.0031	-0.08	-0.05	0.5136
MorA	0.04	0.33	0.0095	-0.05	-0.08	0.7353
MorCD	-0.00	0.33	0.0037	-0.05	-0.08	0.7164
Groundwater	0.10	0.16	0.2420	-0.07	-0.08	0.9029
DripZone	0.11	0.02	0.2720	-0.08	-0.05	0.7575
RedoxA	0.12	-0.38	0.0066	-0.08	0.13	0.3887
RedoxCD	0.12	-0.04	0.1743	-0.08	0.09	0.7859

Response and predictor variables: correlations and relations

Table 7 Kendall's Tau correlation between response variables. **Bold:** p-values of statistical significance, $\alpha = 0.05$, with four decimals. *Italic:* Negative significance, opposite correlation of response and predictor variables

Variable	Coffin		Skeleton		Soft_Parts	
	τ	<i>p</i>	τ	<i>p</i>	τ	<i>p</i>
Skeleton	0.5192	<0.0001	x	x	-	-
Soft_Parts	0.2433	0.0324	0.3282	0.0046	x	x
Textile	0.3392	0.0021	0.3740	0.0009	0.5496	<0.0001

All response variables were positively correlated, showing that the decomposition of one variable might influence the decomposition of the other parts. This might also be an expression of how the different parts decompose in similar environments and respond to the same complex gradients.

Table 8 Kendall's Tau correlation between predictor continuous and ranked factor variables. **Bold:** p-values of statistical significance, $\alpha = 0.05$, with four decimals. *Italic:* Negative significance, opposite correlation of response and predictor variables

Variable	NoPrevBurial		GraveD		HBWhole		HBLow		ColorUpper		ColorLow		TexA	
	τ	p	τ	p	τ	p	τ	p	τ	p	τ	p	τ	p
<i>NoPrevBurial</i>	x	x	-	-	-	-	-	-	-	-	-	-	-	-
GraveD	0.1775	0.0955	x	x	-	-	-	-	-	-	-	-	-	-
<i>HBWhole</i>	0.0017	0.9880	<i>-0.1219</i>	<i>0.2519</i>	x	x	-	-	-	-	-	-	-	-
<i>HBLow</i>	<i>-0.2595</i>	<i>0.0267</i>	<i>-0.1745</i>	<i>0.1037</i>	<i>0.4623</i>	<i><0.0001</i>	x	x	-	-	-	-	-	-
<i>ColorUpper</i>	<i>-0.1048</i>	<i>0.3506</i>	<i>-0.1296</i>	<i>0.2078</i>	0.1976	0.0783	<i>-0.0211</i>	<i>0.8519</i>	x	x	-	-	-	-
<i>ColorLow</i>	<i>-0.0578</i>	<i>0.6064</i>	<i>-0.0569</i>	<i>0.5796</i>	0.2058	0.0663	0.0403	0.7210	<i>0.7541</i>	<i><0.0001</i>	x	x	-	-
TexA	0.0146	0.9013	<i>0.2927</i>	<i>0.0068</i>	0.0132	0.9106	0.1529	0.1983	<i>-0.0276</i>	<i>0.8090</i>	<i>-0.1682</i>	<i>0.1377</i>	x	x
TexCD	<i>-0.0978</i>	<i>0.4057</i>	0.1876	0.0815	<i>-0.0019</i>	<i>0.9874</i>	0.0779	0.5105	<i>-0.1239</i>	<i>0.2751</i>	<i>-0.2881</i>	<i>0.0107</i>	<i>0.8655</i>	<i><0.0001</i>

Among the significant continuous predictor variables, temperature and precipitation had a strong positive correlation, as expected (both variables are derived from climate data at the municipality level). Grave depth had strong positive correlations with temperature and precipitation/location, as also shown in the results (Article Figure 4). The two texture variables also had a strong positive correlation. The texture variables were also positively correlated with precipitation and grave depth. Other variables also had significant correlations. As these did not significantly correlate with the ordination axes representing gradients of decomposition, these correlations were not considered further.

Table 9 Distribution of binary variables state 1 in the municipalities. **Bold variables** represent significant differences in state 0 and 1 along the ordination axes (PCA1 and PCA2) found in the Wilcoxon-Mann-Whitney unpaired two-sample tests. **Bold numbers** represent the highest occurrence of these variables between municipalities

	Bergen	Bærum	Stavanger	Trondheim
<i>GraveT</i>	0	1	9	0
<i>Irrigation</i>	0	14	0	0
<i>Plastic</i>	0	3	0	9
<i>Lime</i>	0	0	0	9
<i>OM</i>	7	2	0	3
<i>MorA</i>	11	0	0	0
<i>MorCD</i>	11	1	0	0
<i>Groundwater</i>	5	1	2	0
<i>DripZone</i>	4	5	3	3
<i>RedoxA</i>	1	4	7	0
<i>RedoxCD</i>	1	1	5	0

Sorting on location of ordered factor and continuous response and predictor variables.

Response variables sorted on location, to look for significant differences between locations. Only small or no significant differences were found between locations on decomposition of coffin, skeleton, soft body parts, and textiles. For soft body parts, there were no significant differences at all.

Coffin

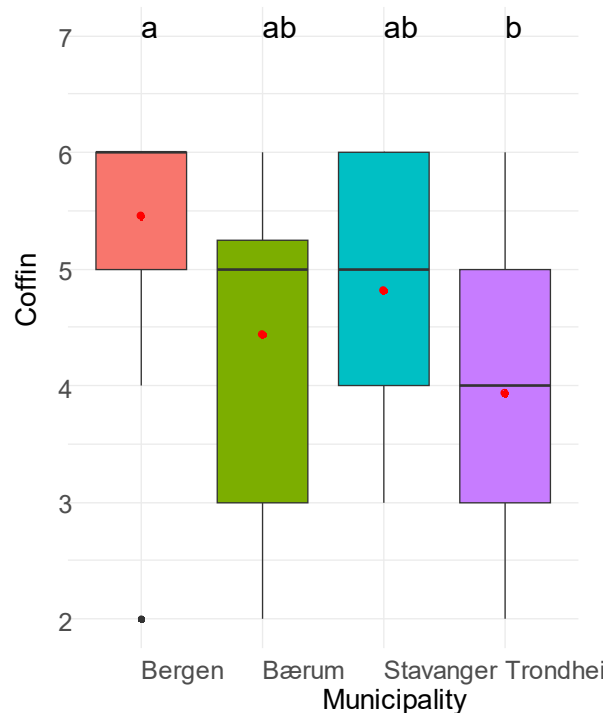


Fig. 1 Box- and whisker plot of coffin decomposition (1: very poor to 6: very good, y-axis) in the four municipalities. Bold line within the boxes are medians. Red dot represents mean grave depth within the municipalities. The box represents the interquartile range (IQR) between 25% and 75% fractions. Whisker lines represent 1.5xIQR. Outliers are given by points beyond IQR

Skeleton

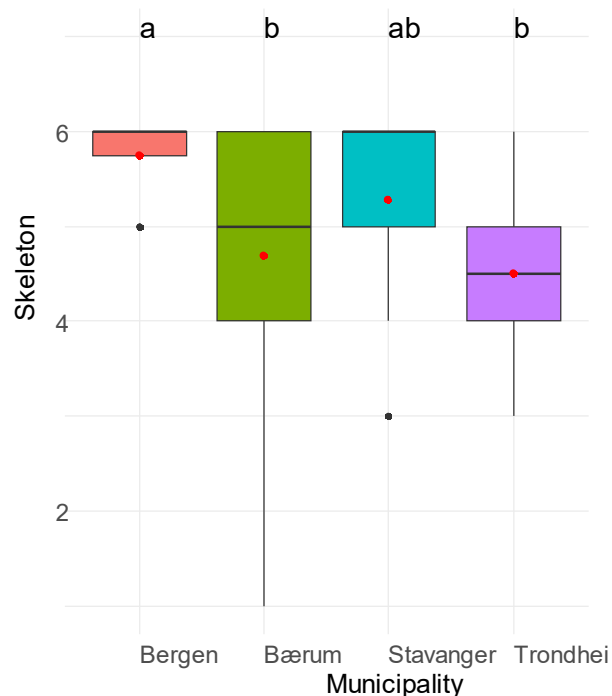


Fig. 2 Box- and whisker plot of skeleton decomposition (1: very poor to 6: very good, y-axis) in the four municipalities. Bold line within the boxes are medians. Red dot represents mean grave depth within the municipalities. The box represents the interquartile range (IQR) between 25% and 75% fractions. Whisker lines represent 1.5xIQR. Outliers are given by points beyond IQR

Soft parts

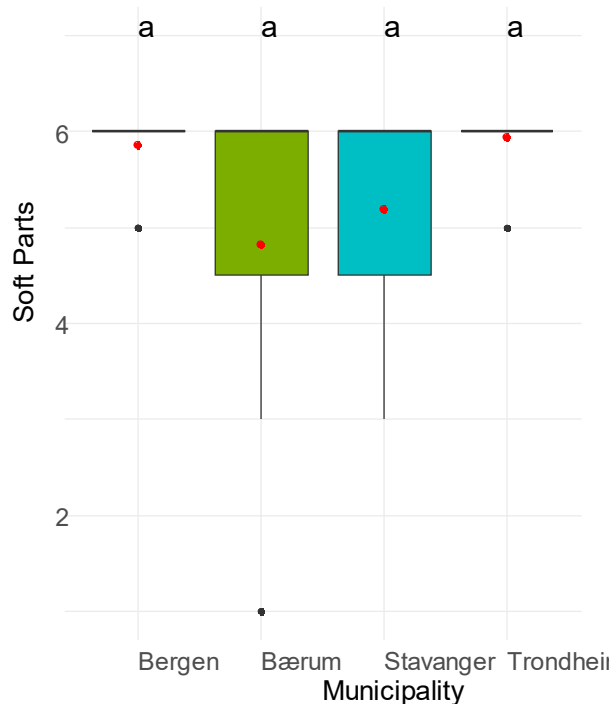


Fig. 3 Box- and whisker plot of decomposition of soft body parts (1: very poor to 6: very good, y-axis) in the four municipalities. Bold line within the boxes are medians. Red dot represents mean grave depth within the municipalities. The box represents the interquartile range (IQR) between 25% and 75% fractions. Whisker lines represent 1.5xIQR. Outliers are given by points beyond IQR

Textiles

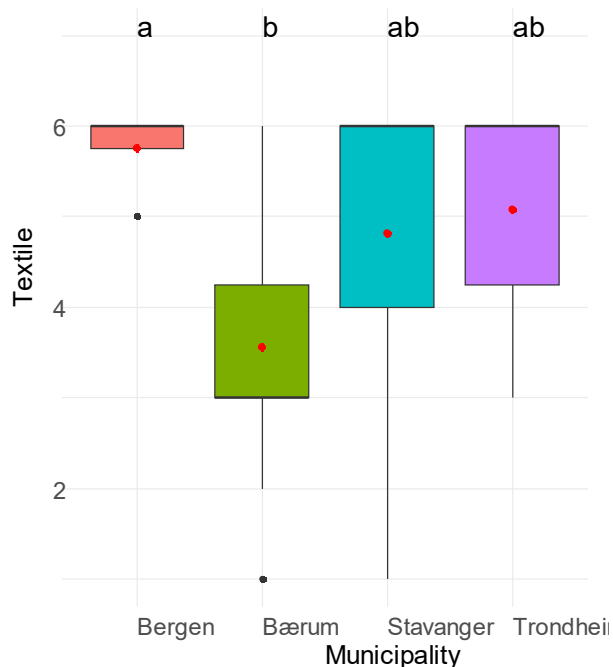


Fig. 4 Box- and whisker plot of textile decomposition (1: very poor to 6: very good, y-axis) in the four municipalities. Bold line within the boxes are medians. Red dot represents mean grave depth within the municipalities. The box represents the interquartile range (IQR) between 25% and 75% fractions. Whisker lines represent 1.5xIQR. Outliers are given by points beyond IQR

Grave Depth (also main text Figure 4)

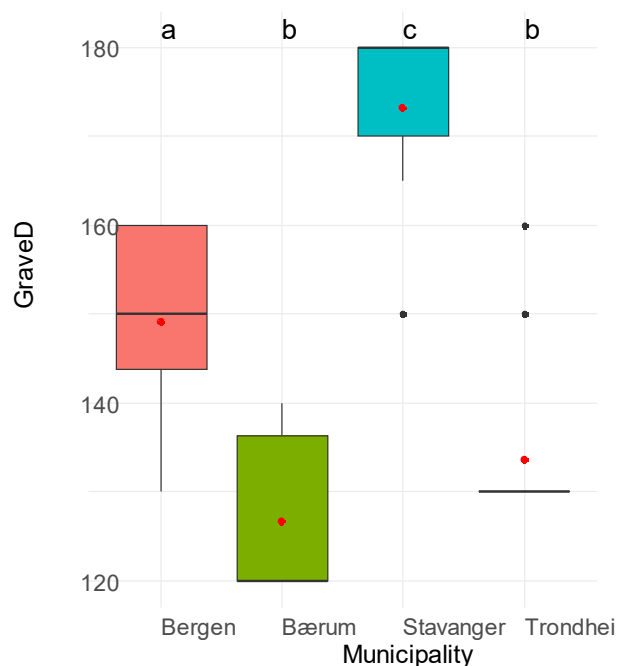


Fig. 5 Box- and whisker plot of grave depth (in cm, from surface level to first found remains) in the four municipalities. Bold line within the boxes are medians. Red dot represents mean grave depth within the municipalities. The box represents the interquartile range (IQR) between 25% and 75% fractions. Whisker lines represent 1.5xIQR. Outliers are given by points beyond IQR

Soil texture above the coffin (TexA)

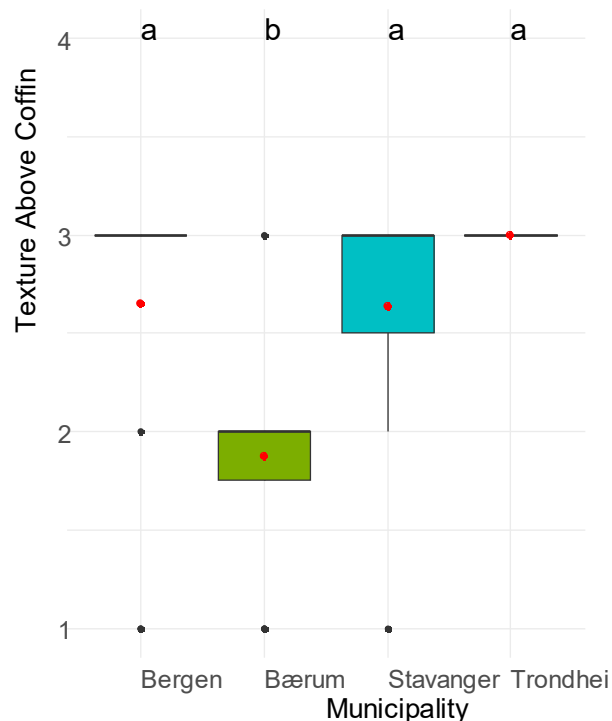


Fig. 6 Box- and whisker plot of soil texture above the coffin (1: clay, 2: silt loam, 3: sand) in the four municipalities. Bold line within the boxes are medians. Red dot represents mean grave depth within the municipalities. The box represents the interquartile range (IQR) between 25% and 75% fractions. Whisker lines represent 1.5xIQR. Outliers are given by points beyond IQR

Soil texture at coffin depth (TexCD)

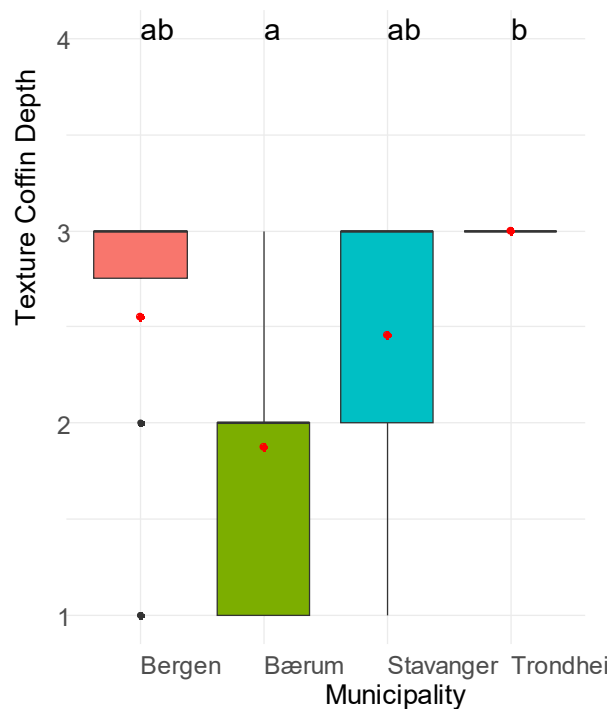


Fig. 7 Box- and whisker plot of soil texture at the coffin depth (1: clay, 2: silt loam, 3: sand) in the four municipalities. Bold line within the boxes are medians. Red dot represents mean grave depth within the municipalities. The box represents the interquartile range (IQR) between 25% and 75% fractions. Whisker lines represent 1.5xIQR. Outliers are given by points beyond IQR

Soil texture was finer in Bærum than the other municipalities. For temperature and precipitation box- and whisker plots, see Supplement 3.

Supplementary material 6

Path diagram of alternative variation partitioning with five groups, in which the group “Municipality” is added to the original four groups (Figure 1). In this scenario, municipality accounts for 16.3% of the explained variation by itself, which may express the effects of climate on decomposition. Various combinations of water, soil, and cemetery management with municipality account for 29.7% of the remaining variation explained in part by municipality and may express covariation between different variables and municipalities (Main text Table 8, Supplement 6 Table 9). The interaction between municipality and plastic, accounting for 14.9% of the variation in this instance, may explain the variation in which Trondheim reused plastic graves treated with lime. Plastic graves may also occur in other municipalities, in which reuse of graves might be limited on the account of no lime treatment.

Water still accounts for a large portion of the variation explained alone, here 21.8%, with additional 13.8% in interactions with other groups. Soil (alone and with other groups) accounts for 34.2% of the variation explained.

Cemetery management explains little of the variation by itself, but accounts for 34.2% of the variation explained in various combinations with other groups.

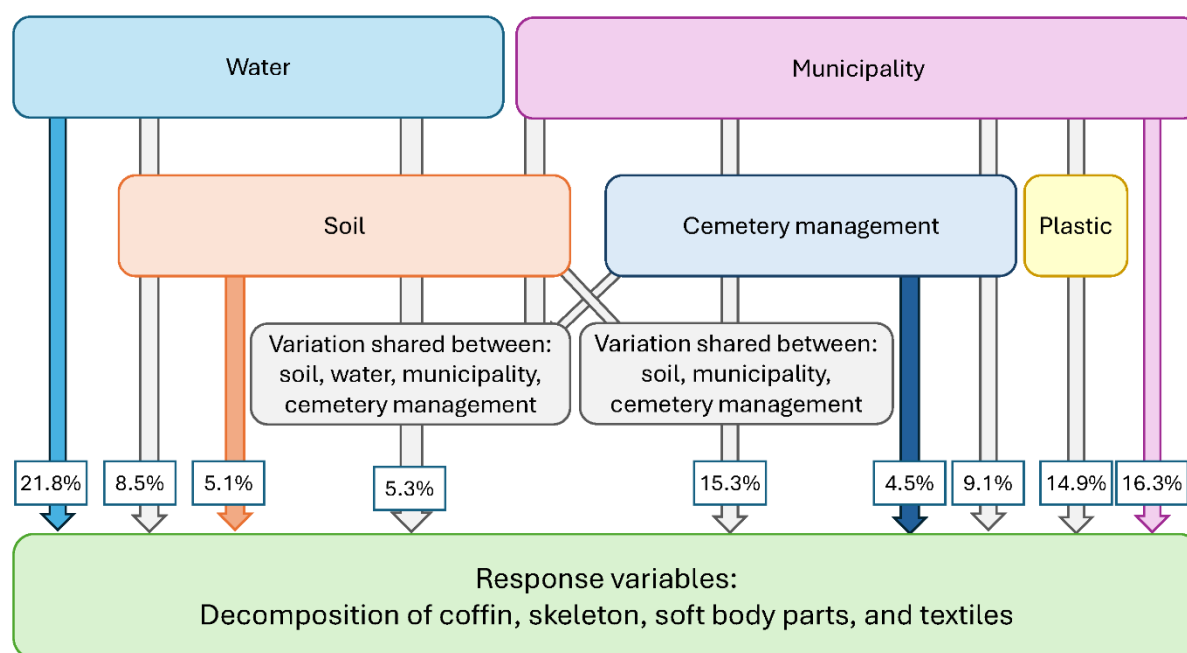


Fig. 1 Path diagram illustrating the results of variation partitioning on five selected groups, including municipality. Light blue represented water properties; cemetery management in darker blue; municipality in pink; plastic-related properties in yellow; soil properties in light orange; shared variation between three groups in gray; response variables in green. Arrows in respectively similar colors