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Evaluation of bacterial glycerol dialkyl glycerol tetraether and ^{2}H–^{18}O biomarker proxies along a central European topsoil transect

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Supplementary method description

We used a random forest approach in order to predict the long term weighted means of precipitation δ^2H and the long term weighted means of precipitation $\delta^{18}O$ for each site. To implement the model, we used the cforest function of the party package (Hothorn et al., 2006; Strobl et al., 2007, 2008) of the software R (R Core Team, 2015). Predictor variables were latitude, squared latitude, longitude and altitude. The explained variance of the random forest for long term weighted means of precipitation $\delta^{18}O$ was 77.5 % and the explained variance of the random forest for long term weighted means of precipitation δ^2H was 82.3%.

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Supplementary figures

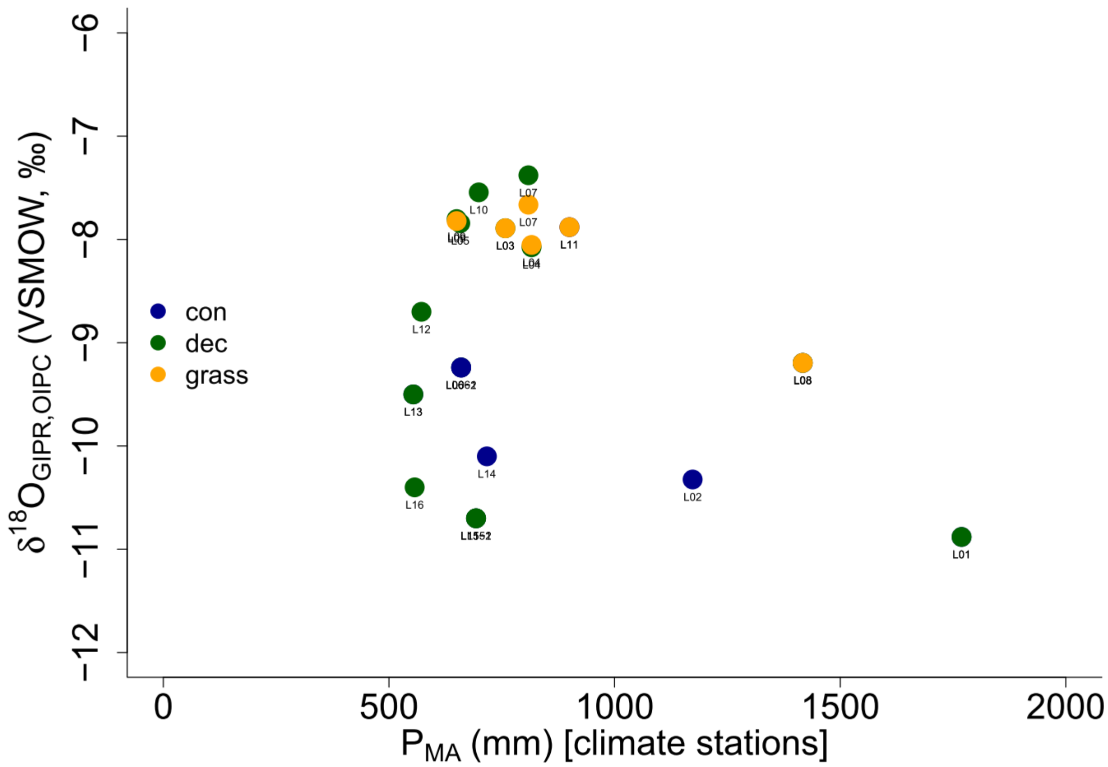

Fig. S1. Comparison between $\delta^{18}O_{GIPR,OIPC}$ values vs. P_{MA} for the three different vegetation types along the transect. All data points are marked with the location names. Abbreviations: con = coniferous forest sites (n=9); dec = deciduous forest sites (n=11); grass = grassland sites (n=4).

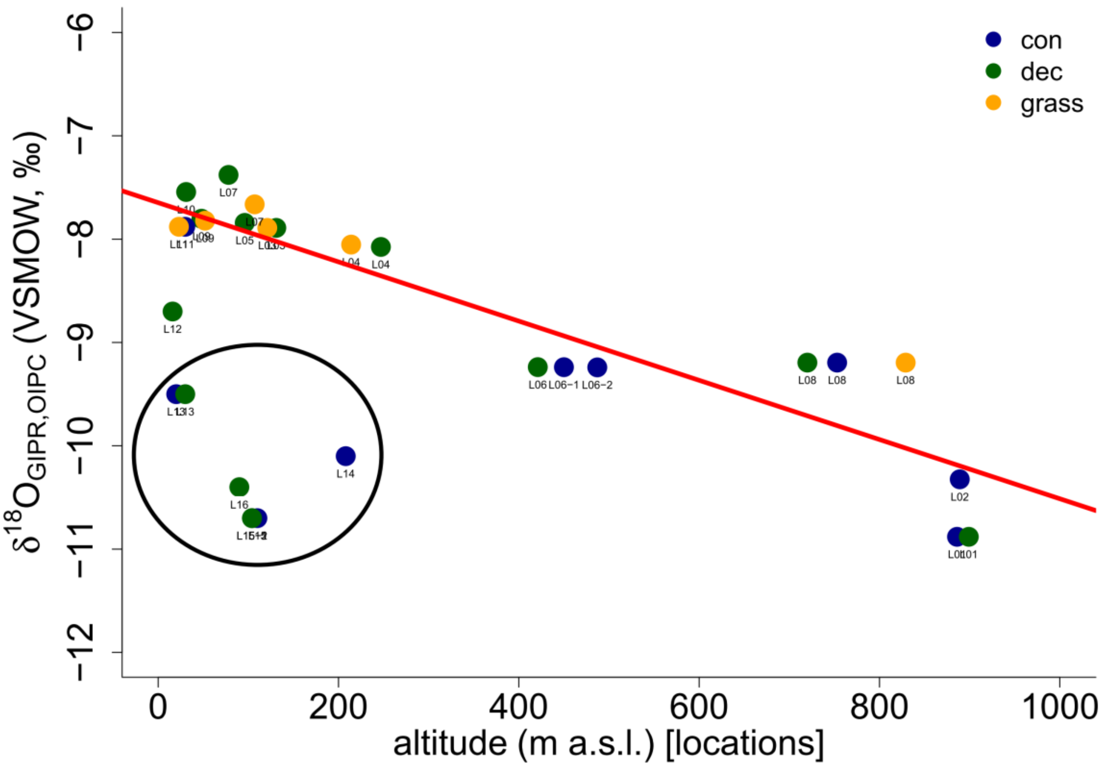

Fig. S2. Comparison between $\delta^{18}O_{GIPR,OIPC}$ values vs. location altitudes for the three different vegetation types along the transect. The red line represents the regression line throughout all German sites. All data points are marked with the location names. Swedish and Danish sites are boarded with a black circle. Abbreviations: con = coniferous forest sites (n=9); dec = deciduous forest sites (n=11); grass = grassland sites (n=4).

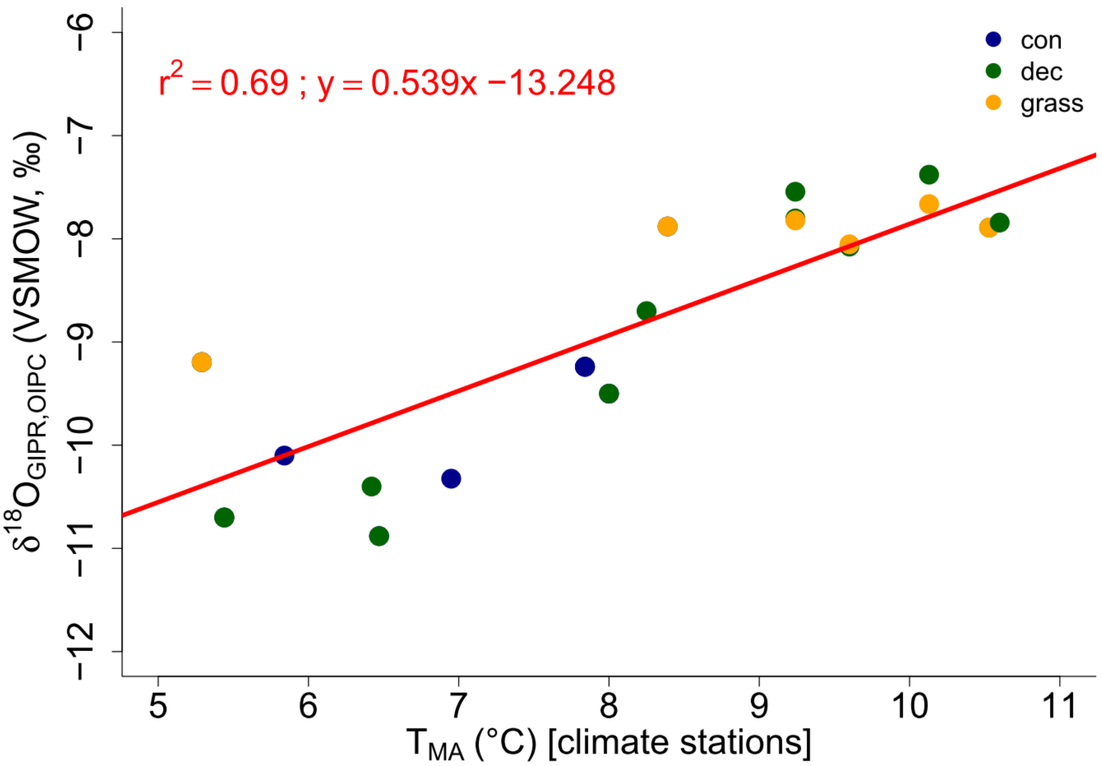

Fig. S3. Comparison between $\delta^{18}O_{GIPR,OIPC}$ values vs. T_{MA} for the three different vegetation types along the transect. The red line represents the regression line throughout all sites. Abbreviations: con = coniferous forest sites (n=9); dec = deciduous forest sites (n=11); grass = grassland sites (n=4).

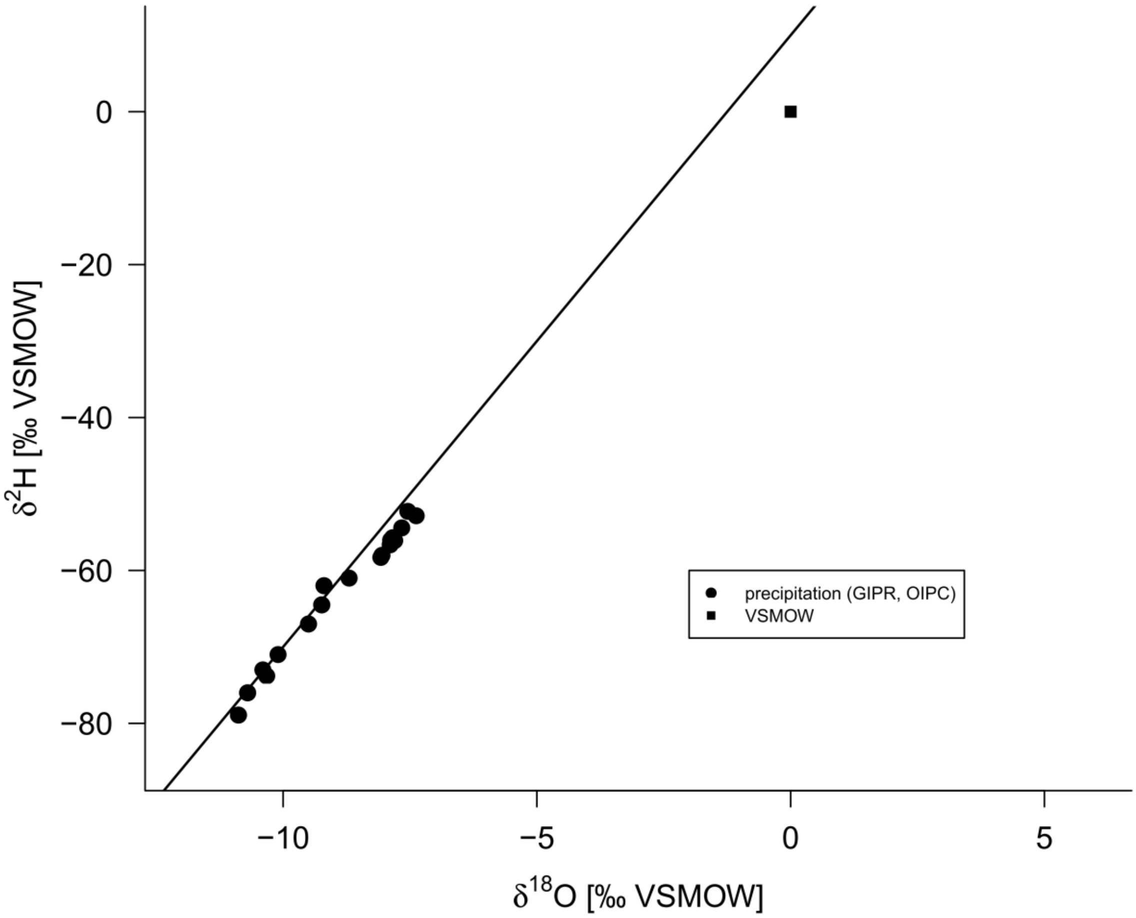

Fig. S4. $\delta^2H_{GIPR,OIPC}$ vs. $\delta^{18}O_{GIPR,OIPC}$ diagram along the transect. The black line represents the global meteoric water line (GMWL; $\delta^2H = 8 \times \delta^{18}O + 10$; Dansgaard, 1964).

Based on the values quoted in the Tabs. S1 and S2, $\delta^{18}O$ is plotted as functions of the reported environmental parameters (climate station P_{MA}, location altitude and T_{MA}; Figs. S1 to S3). It is worth to note that the five points representing Danish and Swedish sites (L12 to L16) form a separate group in Figs. S2 and S3, with clear more negative $\delta^{18}O$ values. All other (continental) sites show a regular altitude effect (decreasing $\delta^{18}O$ values with increasing altitude; red trend in Fig. S3). All Danish and Swedish isotope signatures of precipitation are shifted from the trend line by ca 2 to 2.5‰ towards more negative $\delta^{18}O$ values. One would rather expect more enriched values due to relative proximity to the sea. It should be noted that those values were derived from OIPC, while the $\delta^{18}O$ data for the German sites is derived from GNIP/ANIP data (see section 2.2 for more details). The precipitation $\delta^{18}O$ shows the expected relationship with T_{MA} (Fig. S4). The slope of this relationship (ca. 0.54‰/°C) is in the range of the slope of δ-T spatial relationship observed at mid latitudes of the northern hemisphere (e.g. Rozanski et al., 1993). It is apparent from the above Fig. S5 that the data points plot along the GMWL. Only more positive $\delta^{18}O$ values cluster below the line, indicating most probably some evaporation enrichment effects (partial evaporation of raindrops and/or evaporation effects in the rain gauges).

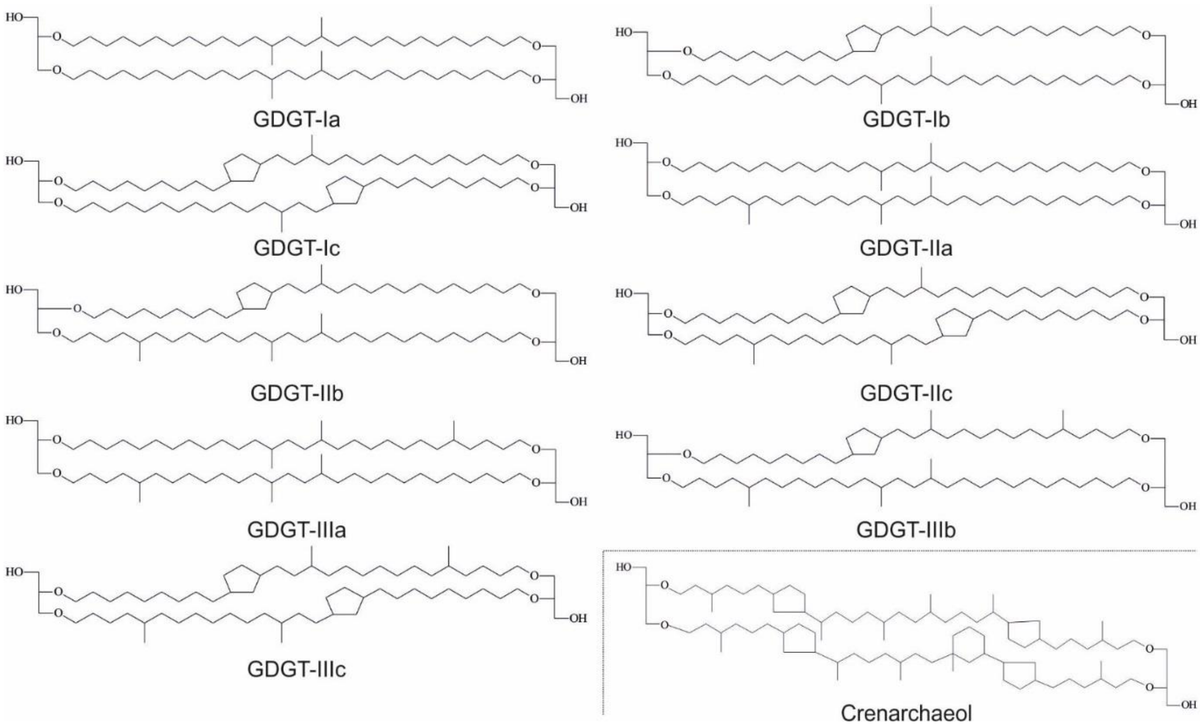

Fig. S5. Structures of brGDGTs and Crenarchaeol mentioned.

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Supplementary data

Tab. S1. Location characterization, GIPR and OIPC data.

Location	Vegetation	Characterization	Latitude (decimal °)	Longitude (decimal °)	Altitude (m)	Precipitation δ^2H (‰)	Precipitation $\delta^{18}O$ (‰)	source
L01	con	spruce forest, steep hillside	47.4	10.3	886	-78.9	-10.9	GIPR [A,B,C,D]
L01	dec	beech forest, close to fir stand	47.4	10.3	899	-78.9	-10.9	GIPR [A,B,C,D]
L02	con	fir forest	47.8	11.0	889	-73.8	-10.3	GIPR [A,B,C,D]
L03	dec	beeches, oaks, limes, sparse pines	49.1	8.2	131	-56.6	-7.9	GIPR [A,B,C,D]
L03	grass	glade, next to farmland and fruit trees (apple, plum)	49.1	8.2	121	-56.6	-7.9	GIPR [A,B,C,D]
L04	dec	beech forest, sparse firs and oaks	49.2	9.5	247	-58.3	-8.1	GIPR [A,B,C,D]
L04	grass	grassland in the valley, next to beech forest	49.2	9.5	214	-58.0	-8.1	GIPR [A,B,C,D]
L05	dec	oak forest, sparse beeches, elms and pines	49.6	8.6	96	-55.7	-7.8	GIPR [A,B,C,D]
L06	dec	beech forest, steep hillside	50.6	10.4	421	-64.5	-9.2	GIPR [A,B,C,D]
L06-1	con1	sparse pine forest with grass layer	50.6	10.4	450	-64.5	-9.2	GIPR [A,B,C,D]
L06-2	con2	sparse larch forest with grass layer	50.6	10.4	487	-64.5	-9.2	GIPR [A,B,C,D]
L07	dec	beeches, acers, elms, oaks	50.8	7.2	78	-52.8	-7.4	GIPR [A,B,C,D]
L07	grass	heath	50.8	7.2	107	-54.4	-7.7	GIPR [A,B,C,D]
L08	con	luxuriant spruce forest	51.2	8.5	753	-62.0	-9.2	GIPR [A,B,C,D]
L08	dec	young beech forest at hillside, close to spruce stand	51.2	8.5	720	-62.0	-9.2	GIPR [A,B,C,D]
L08	grass	heath, small shrubs, close to spruce stand, initially cleared	51.2	8.5	829	-62.0	-9.2	GIPR [A,B,C,D]
L09	dec	birch forest with small oaks, sparse poplars, surrounded by farmland	52.5	9.7	48	-56.1	-7.8	GIPR [A,B,C,D]
L09	grass	next to farm track	52.5	9.7	52	-56.2	-7.8	GIPR [A,B,C,D]
L10	dec	beech-oak-forest	53.0	8.7	31	-52.3	-7.5	GIPR [A,B,C,D]
L11	con	spruce forest with larches	54.4	9.6	30	-56.0	-7.9	GIPR [A,B,C,D]
L11	grass	cow pasture, sparse oaks	54.4	9.6	23	-56.0	-7.9	GIPR [A,B,C,D]
L12	dec	acer forest with poplars, ashes and elder	55.4	10.5	16	-61.0	-8.7	OIPC [E,F,G]
L13	con	fir forest with swampy underground	56.0	12.1	20	-67.0	-9.5	OIPC [E,F,G]
L13	dec	beech forest with sparse acers, birches, loamy underground	56.0	12.1	30	-67.0	-9.5	OIPC [E,F,G]
L14	con	spruce-pine-forest with moss layer	57.6	14.2	208	-71.0	-10.1	OIPC [E,F,G]
L15	con	spruce forest, sparse birches, used as cattle run	58.9	14.9	110	-76.0	-10.7	OIPC [E,F,G]
L15-1	dec1	acers, oaks, beeches, sparse firs, on partly pebbly, partly humus-rich floor	58.9	14.9	104	-76.0	-10.7	OIPC [E,F,G]
L15-2	dec2	birch- and oak-belt at spruce forest edge, grass layer, also used as cattle run	58.9	14.9	104	-76.0	-10.7	OIPC [E,F,G]
L16	dec	oak forest, sparse birches and larches	58.5	15.0	90	-73.0	-10.4	OIPC [E,F,G]

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Tab. S2. Climate station data.

Location	Vegetation	Station ID	Name	Latitude (decimal °)	Longitude (decimal °)	Altitude (m)	Oberservation begin (YYYYMMDD)	Oberservation end (YYYYMMDD)	T_{MA} (°C)	T_{MV} (°C)	Oberservation begin (YYYYMMDD)	Oberservation end (YYYYMMDD)	T_{MDV} (°C)	Station ID	Name	Latitude (decimal °)
L01	con	3730	Oberstdorf	47.40	10.28	806	19480101	20171231	6.5 [A]	11.5 [A]	n.n.	n.n.	14.2 [A]	n.n.	n.n.	n.n.
L01	dec	3730	Oberstdorf	47.40	10.28	806	19480101	20171231	6.5 [A]	11.5 [A]	n.n.	n.n.	14.2 [A]	n.n.	n.n.	n.n.
L02	con	2290	Hohenpeißenberg	47.80	11.01	977	19470101	20171231	7.0 [A]	11.4 [A]	n.n.	n.n.	12.7 [A]	n.n.	n.n.	n.n.
L03	dec	2522	Karlsruhe	49.04	8.36	112	19480101	20081102	10.5 [A]	15.3 [A]	n.n.	n.n.	17.8 [A]	n.n.	n.n.	n.n.
L03	grass	2522	Karlsruhe	49.04	8.36	112	19480101	20081102	10.5 [A]	15.3 [A]	n.n.	n.n.	17.8 [A]	n.n.	n.n.	n.n.
L04	dec	3761	Öhringen	49.21	9.52	276	19550101	20171231	9.6 [A]	14.4 [A]	n.n.	n.n.	16.8 [A]	n.n.	n.n.	n.n.
L04	grass	3761	Öhringen	49.21	9.52	276	19550101	20171231	9.6 [A]	14.4 [A]	n.n.	n.n.	16.8 [A]	n.n.	n.n.	n.n.
L05	dec	5906	Mannheim	49.51	8.56	98	19480101	20171231	10.6 [A]	15.4 [A]	n.n.	n.n.	17.9 [A]	n.n.	n.n.	n.n.
L06	dec	3231	Meiningen	50.56	10.38	450	19790101	20171231	7.8 [A]	12.7 [A]	n.n.	n.n.	14.7 [A]	n.n.	n.n.	n.n.
L06-1	con1	3231	Meiningen	50.56	10.38	450	19790101	20171231	7.8 [A]	12.7 [A]	n.n.	n.n.	14.7 [A]	n.n.	n.n.	n.n.
L06-2	con2	3231	Meiningen	50.56	10.38	450	19790101	20171231	7.8 [A]	12.7 [A]	n.n.	n.n.	14.7 [A]	n.n.	n.n.	n.n.
L07	dec	2667	Köln-Bonn	50.86	7.16	92	19600101	20171231	10.1 [A]	14.4 [A]	n.n.	n.n.	16.7 [A]	n.n.	n.n.	n.n.
L07	grass	2667	Köln-Bonn	50.86	7.16	92	19600101	20171231	10.1 [A]	14.4 [A]	n.n.	n.n.	16.7 [A]	n.n.	n.n.	n.n.
L08	con	2483	Kahler Asten	51.18	8.49	839	19510101	20171231	5.3 [A]	9.6 [A]	n.n.	n.n.	10.9 [A]	n.n.	n.n.	n.n.
L08	dec	2483	Kahler Asten	51.18	8.49	839	19510101	20171231	5.3 [A]	9.6 [A]	n.n.	n.n.	10.9 [A]	n.n.	n.n.	n.n.
L08	grass	2483	Kahler Asten	51.18	8.49	839	19510101	20171231	5.3 [A]	9.6 [A]	n.n.	n.n.	10.9 [A]	n.n.	n.n.	n.n.
L09	dec	2014	Hannover	52.46	9.68	55	19490101	20171231	9.2 [A]	13.7 [A]	n.n.	n.n.	15.9 [A]	n.n.	n.n.	n.n.
L09	grass	2014	Hannover	52.46	9.68	55	19490101	20171231	9.2 [A]	13.7 [A]	n.n.	n.n.	15.9 [A]	n.n.	n.n.	n.n.
L10	dec	691	Bremen	53.05	8.80	4	19490101	20171231	9.2 [A]	13.6 [A]	n.n.	n.n.	15.7 [A]	n.n.	n.n.	n.n.
L11	con	4466	Schleswig	54.53	9.55	43	19510101	20171231	8.4 [A]	12.6 [A]	n.n.	n.n.	14.4 [A]	n.n.	n.n.	n.n.
L11	grass	4466	Schleswig	54.53	9.55	43	19510101	20171231	8.4 [A]	12.6 [A]	n.n.	n.n.	14.4 [A]	n.n.	n.n.	n.n.
L12	dec	06120	Odense Lufthavn	55.48	10.33	15	19610101	20001231	8.3 [C,D]	12.5 [C,D]	n.n.	n.n.	n.a.	n.n.	n.n.	n.n.
L13	con	30110	Spodsbjerg	55.98	11.85	34	19610101	19901231	8.0 [C]	12.5 [C]	n.n.	n.n.	n.a.	n.n.	n.n.	n.n.
L13	dec	30110	Spodsbjerg	55.98	11.85	34	19610101	19901231	8.0 [C]	12.5 [C]	n.n.	n.n.	n.a.	n.n.	n.n.	n.n.
L14	con	74180	Hagshult Mo	57.29	14.13	169	19430101	20180601	5.8 [F]	10.8 [F]	19490101	20180601	14.5 [F]	n.n.	n.n.	n.n.
L15	con	84580	Snavlunda	58.97	14.90	144/140	19440101	19830901	5.4 [F]	10.8 [F]	19941014	19830831	13.9 [F]	85460	Kettstaka A	58.72
L15-1	dec1	84580	Snavlunda	58.97	14.90	144/140	19440101	19830901	5.4 [F]	10.8 [F]	19941014	19830831	13.9 [F]	85460	Kettstaka A	58.72
L15-2	dec2	84580	Snavlunda	58.97	14.90	144/140	19440101	19830901	5.4 [F]	10.8 [F]	19941014	19830831	13.9 [F]	85460	Kettstaka A	58.72
L16	dec	85330	Motala Kraftverk	58.55	15.08	94	19340101	19901228	6.4 [F]	11.6 [F]	19610101	19851024	14.9 [F]	84310	Karlsborg Mo	58.51

n.n. = not needed/see information further left

n.a. = not available

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Tab. S2. continuation…

Longitude (decimal °)	Altitude (m)	Oberservation begin (YYYYMMDD)	Oberservation end (YYYYMMDD)	RH_{MA} (%)	RH_{MV} (%)	RH_{MDV} (%)	Name	Latitude (decimal °)	Longitude (decimal °)	Altitude (m)	Oberservation begin (YYYYMMDD)	Oberservation end (YYYYMMDD)	P_{MA} (mm)	Source
n.n.	n.n.	n.n.	n.n.	82 [A]	80 [A]	70 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	1769 [B]	DWD
n.n.	n.n.	n.n.	n.n.	82 [A]	80 [A]	70 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	1769 [B]	DWD
n.n.	n.n.	n.n.	n.n.	78 [A]	77 [A]	73 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	1173 [B]	DWD
n.n.	n.n.	n.n.	n.n.	77 [A]	73 [A]	63 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	758 [B]	DWD
n.n.	n.n.	n.n.	n.n.	77 [A]	73 [A]	63 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	758 [B]	DWD
n.n.	n.n.	n.n.	n.n.	77 [A]	74 [A]	65 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	816 [B]	DWD
n.n.	n.n.	n.n.	n.n.	77 [A]	74 [A]	65 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	816 [B]	DWD
n.n.	n.n.	n.n.	n.n.	75 [A]	71 [A]	61 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	658 [B]	DWD
n.n.	n.n.	n.n.	n.n.	79 [A]	75 [A]	67 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	660 [B]	DWD
n.n.	n.n.	n.n.	n.n.	79 [A]	75 [A]	67 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	660 [B]	DWD
n.n.	n.n.	n.n.	n.n.	79 [A]	75 [A]	67 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	660 [B]	DWD
n.n.	n.n.	n.n.	n.n.	77 [A]	74 [A]	65 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	809 [B]	DWD
n.n.	n.n.	n.n.	n.n.	77 [A]	74 [A]	65 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	809 [B]	DWD
n.n.	n.n.	n.n.	n.n.	87 [A]	84 [A]	78 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	1417 [B]	DWD
n.n.	n.n.	n.n.	n.n.	87 [A]	84 [A]	78 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	1417 [B]	DWD
n.n.	n.n.	n.n.	n.n.	87 [A]	84 [A]	78 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	1417 [B]	DWD
n.n.	n.n.	n.n.	n.n.	80 [A]	76 [A]	68 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	650 [B]	DWD
n.n.	n.n.	n.n.	n.n.	80 [A]	76 [A]	68 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	650 [B]	DWD
n.n.	n.n.	n.n.	n.n.	80 [A]	77 [A]	69 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	699 [B]	DWD
n.n.	n.n.	n.n.	n.n.	83 [A]	80 [A]	72 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	900 [B]	DWD
n.n.	n.n.	n.n.	n.n.	83 [A]	80 [A]	72 [A]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	900 [B]	DWD
n.n.	n.n.	19800101	19971231	81 [C]	76 [C]	63 [C]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	572 [E]	DMI
n.n.	n.n.	19690101	19921231	84 [C]	80 [C]	74 [C]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	554 [E]	DMI
n.n.	n.n.	19690101	19921231	84 [C]	80 [C]	74 [C]	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	554 [E]	DMI
n.n.	n.n.	20130101	20180601	86 [F]	79 [F]	68 [F]	n.n.	n.n.	n.n.	n.n.	19430101	20180601	717 [F]	SMHI
15.03	225	19950801	20180601	82 [F]	75 [F]	68 [F]	Snavlunda D	58.95/58.97/58.97	14.91/14.90/14.90	135/144/140	19440101	20150101	693 [F]	SMHI
15.03	225	19950801	20180601	82 [F]	75 [F]	68 [F]	Snavlunda D	58.95/58.97/58.97	14.91/14.90/14.90	135/144/140	19440101	20150101	693 [F]	SMHI
15.03	225	19950801	20180601	82 [F]	75 [F]	68 [F]	Snavlunda D	58.95/58.97/58.97	14.91/14.90/14.90	135/144/140	19440101	20150101	693 [F]	SMHI
14.51	95	20130101	20180601	83 [F]	78 [F]	71 [F]	Motala	58.56/58.55/58.55	15.02/15.01/15.08	95/95/94	19310101	20180501	557 [F]	SMHI

Tab. S3. GDGT data. Crenarcheol and brGDGTs in µg/g dry weight.

Location	Vegetation	pH (H_2O)	Crenarcheol [A] (ng/g dry weight)	IIIa [A] (ng/g dry weight)	IIIb [A] (ng/g dry weight)	IIIc [A] (ng/g dry weight)	IIa [A] (ng/g dry weight)	IIb [A] (ng/g dry weight)	IIc [A] (ng/g dry weight)	Ia [A] (ng/g dry weight)	Ib [A] (ng/g dry weight)	Ic [A] (ng/g dry weight)
L01	con	4.5	2	194	3	0	845	34	1	531	38	7
L01	dec	4.0	1	109	1	0	536	7	3	687	37	10
L02	con	6.5	38	128	9	1	329	81	4	160	86	79
L03	dec	4.3	16	55	0	0	617	17	5	1289	30	9
L03	grass	5.2	12	28	0	0	142	8	1	124	12	2
L04	dec	5.9	13	60	4	1	185	37	3	137	33	6
L04	grass	6.0	208	54	7	3	131	105	8	79	92	27
L05	dec	4.1	15	25	0	0	204	2	1	380	5	1
L06	dec	7.3	16	226	26	1	304	184	6	78	66	5
L06-1	con1	4.5	2	116	0	0	585	18	2	549	21	1
L06-2	con2	6.0	19	332	24	2	695	197	7	295	97	12
L07	dec	3.6	149	67	1	1	506	10	4	677	16	5
L07	grass	4.2	18	19	0	0	141	1	1	183	2	1
L08	con	3.3	29	213	0	0	2265	26	19	3287	32	13
L08	dec	3.6	11	84	0	0	821	12	5	1450	21	8
L08	grass	4.3	0	232	0	0	996	11	2	884	21	6
L09	dec	3.6	64	101	1	0	943	13	5	1513	19	8
L09	grass	4.3	16	26	1	0	169	1	1	275	5	1
L10	dec	3.0	1084	157	33	4	463	68	17	816	23	8
L11	con	3.5	512	76	0	1	353	6	0	406	8	2
L11	grass	5.9	19	89	0	0	579	26	2	714	44	5
L12	dec	4.9	735	450	16	2	2219	418	36	1642	476	142
L13	con	3.2	0	56	0	3	619	0	6	993	13	20
L13	dec	3.7	0	150	0	0	1422	28	16	3165	46	19
L14	con	3.6	0	103	2	0	1180	5	9	2077	17	4
L15	con	3.6	0	207	3	1	2866	48	26	5695	98	35
L15-1	dec1	5.0	7	192	2	0	933	41	4	658	58	22
L15-2	dec2	4.1	5	210	1	0	1896	24	14	2541	41	13
L16	dec	4.3	0	54	0	0	349	5	1	424	9	2

[A] structures can be found in Fig. S5

[B] BIT index was calculated according to Hopmans, E.C., Weijers, J.W.H., Schefuß, E., Herfort, L., Sinninghe Damsté, J.S., Schouten, S., 2004. A novel proxy for terrestrial organic matter in sediments based on branched and isoprenoid tetraether lipids. Earth and Planetary Science Letters 224, 107–116.

[C] MBT', CBT, reconstructed T_{MA} and pHCBT according to Peterse, F., van der Meer, J., Schouten, S., Weijers, J.W.H., Fierer, N., Jackson, R.B., Kim, J.H., Sinninghe Damsté, J.S., 2012. Revised calibration of the MBT-CBT paleotemperature proxy based on branched tetraether membrane lipids in surface soils. Geochimica et Cosmochimica Acta 96, 215–229.

Tab. S3. continuation…

brGDGT concentration (µg/g dry weight)	BIT	MBT'	CBT	reconstructed T_{MA} (°C)	pH_{CBT}
1.65	1.00	0.35	1.3	4.3	5.37
1.39	1.00	0.53	1.4	9.0	5.05
0.88	0.94	0.37	0.5	9.8	6.98
2.02	0.99	0.66	1.6	12.1	4.74
0.32	0.96	0.43	1.1	7.9	5.69
0.47	0.97	0.38	0.7	8.9	6.59
0.51	0.56	0.40	0.0	13.0	7.84
0.62	0.98	0.63	2.0	9.0	4.01
0.90	0.97	0.17	0.2	5.1	7.54
1.29	1.00	0.44	1.5	6.3	5.04
1.66	0.99	0.25	0.5	5.5	6.86
1.29	0.89	0.54	1.7	8.2	4.63
0.35	0.95	0.53	2.0	5.9	3.90
5.86	1.00	0.57	2.0	7.2	4.00
2.40	1.00	0.62	1.8	9.4	4.26
2.15	1.00	0.42	1.8	3.8	4.39
2.60	0.98	0.59	1.9	8.5	4.19
0.48	0.97	0.59	1.9	8.5	4.23
1.59	0.57	0.55	1.2	11.2	5.63
0.85	0.62	0.49	1.7	6.2	4.50
1.46	0.99	0.52	1.3	9.8	5.40
5.40	0.85	0.42	0.6	10.2	6.65
1.71	1.00	0.60	2.1	7.6	3.78
4.85	1.00	0.67	1.8	11.3	4.37
3.40	1.00	0.62	2.2	7.7	3.64
8.98	1.00	0.65	1.8	10.9	4.42
1.91	1.00	0.39	1.2	6.0	5.52
4.74	1.00	0.55	1.8	7.4	4.29
0.84	1.00	0.52	1.7	6.9	4.46

Tab. S4. Measured n-alkane δ^2H and sugar $\delta^{18}O$ data along with calculations and reconstruction results.

Location	Vegetation	n-alkane δ^2H (‰)	sugar $\delta^{18}O$ (‰)	$\varepsilon_{n\text{-alkane/precipitation}}$ (‰)	$\varepsilon_{\text{sugar/precipitation}}$ (‰)	reconstructed $\delta^2H_{\text{source-water}}$ (‰)	reconstructed $\delta^{18}O_{\text{source-water}}$ (‰)	reconstructed RH_{MDV} (‰)
L01	con	-216.2	34.17	-149	45.5	-139	-18.7	34
L01	dec	-190.6	35.95	-121	47.3	-100	-13.8	42
L02	con	-169.4	32.95	-103	43.7	-49	-7.3	66
L03	dec	-176.8	34.54	-127	42.8	-67	-9.6	56
L03	grass	n.a.	29.96	n.a.	38.1	n.a.	n.a.	n.a.
L04	dec	n.a.	35.30	n.a.	43.7	n.a.	n.a.	n.a.
L04	grass	-208.6	30.80	-160	39.2	-110	-14.9	52
L05	dec	-169.6	32.95	-121	41.1	-47	-7.1	66
L06	dec	n.a.	34.30	n.a.	43.9	n.a.	n.a.	n.a.
L06-1	con1	-201.5	34.27	-146	43.9	-113	-15.3	42
L06-2	con2	-191.0	34.39	-135	44.0	-94	-13.0	48
L07	dec	-170.4	36.07	-124	43.8	-62	-9.0	54
L07	grass	n.a.	31.28	n.a.	39.2	n.a.	n.a.	n.a.
L08	con	-168.3	38.42	-113	48.1	-72	-10.2	45
L08	dec	-156.3	36.19	-101	45.8	-40	-6.2	61
L08	grass	-184.2	31.51	-130	41.1	-71	-10.1	63
L09	dec	-177.8	31.66	-129	39.8	-57	-8.4	66
L09	grass	-191.6	28.30	-144	36.4	-69	-9.8	71
L10	dec	-171.6	39.45	-126	47.3	-79	-11.1	40
L11	con	-183.6	33.56	-135	41.8	-77	-10.8	55
L11	grass	-194.1	27.67	-146	35.8	-71	-10.1	72
L12	dec	-177.4	37.30	-124	46.4	-83	-11.6	44
L13	con	-182.9	36.62	-124	46.6	-90	-12.5	44
L13	dec	-183.8	28.79	-125	38.7	-57	-8.4	74
L14	con	-190.3	36.85	-128	47.4	-103	-14.1	39
L15	con	-201.1	32.13	-135	43.3	-103	-14.1	51
L15-1	dec1	-201.6	33.41	-136	44.6	-110	-15.0	45
L15-2	dec2	-209.7	33.05	-145	44.2	-123	-16.6	42
L16	dec	-191.6	28.41	-128	39.2	-69	-9.9	71

n.a. = not available