Table S1a Information on IsoJar^{TM} samples of Funaki et al. (2012)

Sample ID	Sampling date* (dd/mm/yyyy)	Analysis date* (dd/mm/yyyy)	Sampling depth of cores (ground level -m)	$\delta^{13}C_{CH4}$ (‰ VPDB)	$\delta^{13}C_{CO2}$ (‰ VPDB)
PB1-1	17/12/2007	12/02/2008	262.9	-52.8	+4.7
PB1-2	18/12/2007	12/02/2008	274.4	-48.8	-2.6
PB1-3	18/12/2007	12/02/2008	280.4	-41.1	-4.6
PB1-4	18/12/2007	12/02/2008	288.0	-53.3	+4.2
PB1-5	18/12/2007	12/02/2008	289.5	-51.1	+2.1
PB1-6	19/12/2007	12/02/2008	299.2	-53.6	+3.7
PB1-7	20/12/2007	12/02/2008	307.7	-53.9	+5.6
PB1-8	21/12/2007	13/02/2008	316.9	-50.6	+4.1
PB1-9	21/12/2007	13/02/2008	325.5	-54.2	+5.0
PB1-10	22/12/2007	13/02/2008	336.1	-52.4	+9.3
PB1-11	22/12/2007	13/02/2008	343.0	-53.4	+9.1
PB1-12	23/12/2007	13/02/2008 14/02/2008	355.0	-49.1	+12.2
PB1-13	18/01/2008	14/02/2008	367.0	-55.5	+6.8
PB1-14	19/01/2008	14/02/2008	375.7	-55.8	+6.2
PB1-15	20/01/2008	14/02/2008	385.0	-54.7	+8.7
PB1-16	20/01/2008	14/02/2008	397.3	-54.8	+9.8
PB1-17	21/01/2008	15/02/2008	405.7	-51.8	+3.9
PB1-18	22/01/2008	15/02/2008	416.0	-47.7	-0.2
PB1-19	23/01/2008	15/02/2008	425.4	-56.1	+3.6
PB1-20	24/01/2008	15/02/2008	435.0	-56.2	+4.1
PB1-21	24/01/2008	15/02/2008	445.0	-53.8	+3.0
PB1-22	25/01/2008	18/02/2008	455.0	-52.9	+2.3
PB1-23	26/01/2008	18/02/2008 21/02/2008	465.0	-53.6	+3.5
PB1-24	28/01/2008	18/02/2008 21/02/2008	485.0	-55.8	+4.8
PB1-25	30/01/2008	20/02/2008	504.0	-51.9	+0.7
PB1-26	31/01/2008	20/02/2008	515.0	-45.7	+2.2
PB1-27	31/01/2008	20/02/2008	520.0	-49.5	+0.9

*These information are unpublished data in Funaki et al. (2012).

Table S1b Information on IsoJar™ samples of Funaki et al. (2012)

Sample ID	Sampling date* (dd/mm/yyyy)	Analysis date* (dd/mm/yyyy)	Sampling depth of cores (ground level -m)	$\delta^{13}C_{CH4}$ (‰ VPDB)	$\delta^{13}C_{CO2}$ (‰ VPDB)
SAB1-1	31/10/2008	04/02/2009	150.2	-31.5	-1.7
SAB1-2	05/11/2008	04/02/2009	160.0		-5.4
SAB1-3	05/11/2008	04/02/2009	170.0		-5.2
SAB1-4	06/11/2008	04/02/2009	180.0	-26.3	-10.0
SAB1-5	06/11/2008	06/02/2009	190.0	-31.4	-5.4
SAB1-6	07/11/2008	06/02/2009	200.0	-54.5	+3.7
SAB1-7	07/11/2008	06/02/2009	210.0	-13.4	-7.0
SAB1-8	07/11/2008	06/02/2009	220.0	-49.9	-2.4
SAB1-9	08/11/2008	06/02/2009	230.0	-55.9	-6.8
SAB1-10	08/11/2008	10/02/2009	240.0	-37.6	-2.0
SAB1-11	08/11/2008	10/02/2009	250.0	-40.3	-9.5
SAB1-12	09/11/2008	10/02/2009	260.0	-15.0	-12.4
SAB1-13	09/11/2008	10/02/2009	270.0	-53.8	+3.1
SAB1-14	10/11/2008	10/02/2009	280.0	-48.1	-2.7
SAB1-15	20/11/2008	10/02/2009	290.0	-43.6	-8.4
SAB1-16	11/11/2008	12/02/2009	300.2	-52.1	-0.9
SAB1-17	03/12/2008	12/02/2009	310.1	-48.8	-2.4
SAB1-18	04/12/2008	12/02/2009	320.0	-38.4	-9.0
SAB1-19	13/12/2008	12/02/2009 25/02/2009	330.1	-50.2	-0.6
SAB1-20	14/12/2008	12/02/2009	340.0	-50.2	+2.9
SAB1-21	15/12/2008	19/02/2009	350.0	-52.1	+6.5
SAB1-22	15/12/2008	19/02/2009	360.0	-37.0	-2.3
SAB1-23	16/12/2008	19/02/2009	370.0	-50.2	+0.5
SAB1-24	16/12/2008	19/02/2009	379.4	-33.6	-3.7
SAB1-25	18/12/2008	19/02/2009	399.0	-46.3	+0.4
SAB1-26	06/01/2009	20/02/2009	410.0	-50.3	+3.6
SAB1-27	07/01/2009	20/02/2009	420.7	-41.4	-3.5
SAB1-28	08/01/2009	20/02/2009	430.0	-45.9	-2.6
SAB1-29	08/01/2009	20/02/2009	440.0	-40.1	+0.8
SAB1-30	09/01/2009	24/02/2009	450.0	-31.6	-0.1
SAB1-31	11/01/2009	24/02/2009	470.0	-46.8	+0.8
SAB1-32	11/01/2009	24/02/2009	480.0		-4.0
SAB1-33	12/01/2009	24/02/2009	490.0	-20.5	-2.0
SAB1-34	13/01/2009	24/02/2009	500.0	-23.0	-4.7
SAB1-35	13/01/2009	25/02/2009	510.0	-48.0	-6.4

*These information are unpublished data in Funaki et al. (2012).

Table S2 Information on IsoJar^{TM} samples and analytical results of head-space gases

Sample no.	Sampling date (dd/mm/yyyy)	Analysis date (dd/mm/yyyy)	Sampling depth of cores (ground level -m)	C_2H_6 (ppm)	C_3H_8 (ppm)	$\delta^{13}C_{CO2} - \delta^{13}C_{CH4}$ (‰ VPDB)
IJ1	10/11/2016	16/1/2017	384.9–385.9	1	nd*	59.0
IJ2	06/12/2016	16/1/2017	395.0–396.0	15	nd*	48.7
IJ3	19/12/2016	08/03/2017	413.4–415.4	15	nd*	44.0
IJ4	02/12/2016	19/12/2016	394.5–395.0	5	nd*	54.3
IJ5	10/11/2016	17/01/2017	384.9–385.9	1	nd*	53.5
IJ6	06/12/2016	17/01/2017	395.0–396.0	26	nd*	46.0
IJ7	19/12/2016	08/03/2017	415.4–416.3	21	nd*	35.8
IJ8	19/12/2016	08/03/2017	413.4–415.4	2	nd*	20.9
IJ9	10/11/2016	29/11/2016	382.8–383.8	18	2	72.9
IJ10	10/11/2016	16/01/2017	384.9–385.9	15	nd*	55.2
IJ11	06/12/2016	16/01/2017	395.0–396.0	35	nd*	64.5
IJ12	06/12/2016	08/03/2017	394.5–396.0	4	nd*	39.7
IJ13	10/11/2016	29/11/2016	383.8–384.9	37	2	61.3
IJ14	10/11/2016	17/01/2017	384.9–385.9	1	nd*	-2.0
IJ15	06/12/2016	17/01/2017	395.0–396.0	24	nd*	49.7
IJ16	19/12/2016	08/03/2017	413.4–415.4	9	nd*	40.7
IJ17	10/11/2016	29/11/2016	382.8–383.8	5	1	64.7
IJ18	10/11/2016	16/01/2017	383.8–384.9	11	nd*	58.1
IJ19	06/12/2016	16/01/2017	395.0–396.0	37	2	62.9
IJ20	19/12/2016	08/03/2017	413.4–415.4	21	nd*	60.6
IJ21	10/11/2016	29/11/2016	383.8–384.9	5	nd*	50.0
IJ22	10/11/2016	17/01/2017	383.8–384.9	10	nd*	29.5
IJ23	06/12/2016	17/01/2017	395.0–396.0	24	nd*	47.0
IJ24	19/12/2016	08/03/2017	413.4–415.4	28	nd*	44.0
IJ25	19/12/2016	08/03/2017	415.4–416.3	33	nd*	46.7
IJ26	22/02/2017	27/02/2017	470.0–470.4	17	nd*	69.9
IJ27	22/02/2017	27/02/2017	470.0–470.4	16	nd*	68.6
IJ28	22/02/2017	27/02/2017	470.0–470.4	11	nd*	70.6

*nd = not detected.

Table S3 Information on IsoJar^{TM} samples and analytical results of head-space gases for Section 3.1.2

Sample no.	Sampling date (dd/mm/yyyy)	Analysis date (dd/mm/yyyy)	C_2H_6 (ppm)	C_3H_8 (ppm)	$\delta^{13}C_{CO2} - \delta^{13}C_{CH4}$ (‰ VPDB)
IJ29	28/06/2017	25/07/2017	2	4	62.5
IJ30	28/06/2017	25/07/2017	1	3	89.8
IJ31	28/06/2017	25/07/2017	2	5	88.2
IJ32	28/06/2017	25/07/2017	2	5	97.8
IJ33	28/06/2017	25/07/2017	3	5	102.4
IJ34	28/06/2017	26/07/2017	3	4	88.7
IJ35	28/06/2017	26/07/2017	8	9	71.0
IJ36	28/06/2017	26/07/2017	11	9	102.8
IJ37	28/06/2017	26/07/2017	5	2	71.0
IJ38	28/06/2017	26/07/2017	4	2	72.4
IJ39	28/06/2017	27/07/2017	7	4	68.2
IJ40	28/06/2017	27/07/2017	9	8	71.2
IJ41	28/06/2017	27/07/2017	3	2	74.0
IJ42	28/06/2017	27/07/2017	1	2	78.0
IJ43	28/06/2017	27/07/2017	2	2	80.4
IJ44	28/06/2017	27/07/2017	2	3	74.9
IJ45	28/06/2017	28/07/2017	2	3	77.8
IJ46	28/06/2017	28/07/2017	2	3	77.1
IJ47	28/06/2017	28/07/2017	2	2	78.9
IJ48	28/06/2017	28/07/2017	2	4	78.2

Table S4 Carbon isotope ratios in methane, and total inorganic carbon (TIC), methane, and TIC contents in EV samples

Sample no.	Sampling date (dd/mm/yyyy)	Analysis date (dd/mm/yyyy)	Storage period (days)	Sampling depth of groundwater (ground level -m)	$\delta^{13}C_{CH4}$ (‰ VPDB)	$\delta^{13}C_{CO2}$ (‰ VPDB)	$\delta^{13}C_{CO2} - \delta^{13}C_{CH4}$ (‰ VPDB)	Concentration of dissolved CH_4 (mmol kg^{-1})	Concentration of total inorganic carbon (TIC) (mmol kg^{-1})
EV1	26/10/2016	01/11/2016	6	248.5	-56.7	+17.1	73.8	-	-
EV2	26/10/2016	20/12/2016	55	248.5	-54.0	+17.8	71.8	7.8	-
EV3	26/10/2016	01/02/2017	98	248.5	-53.7	+17.3	71.0	8.5	-
EV4	26/10/2016	01/11/2016	6	248.5	-56.8	+16.9	73.7	8.7	42
EV5	26/10/2016	20/12/2016	55	248.5	-54.5	+16.2	70.6	6.7	37
EV6	26/10/2016	01/02/2017	98	248.5	-52.7	+16.7	69.4	6.7	35