

Supplementary table 1. The quartz/feldspar (Q/S) and Q/S with logarithmic function (log Q/S), (chlorite + kaolinite)/illite (CK/I) and chlorite/illite (C/I) ratios in bulk fraction of the Beaufort Sea surface sediments

Cruise	Station	Latitude (°N)	Longitude (°E)	Water	Q/F	Log		
				depth (m)		Q/F	C+K/I	C/I
ARA4C	01MUC1B	71.8987	-154.0939	257	14.22	1.15	1.52	0.79
ARA4C	02MUC2B	71.8970	-154.0826	235	16.17	1.21	1.50	0.60
ARA4C	04MUC2B	71.6348	-152.4005	282	15.87	1.20	1.62	0.65
ARA4C	07MUC2B	69.9917	-137.8675	127	22.47	1.35	1.17	0.47
ARA4C	25MUC2B	70.6147	-135.6457	75	23.70	1.37	1.16	0.50
ARA4C	26MUC3B	70.6600	-135.5461	97	40.72	1.61	1.16	0.50
ARA4C	27MUC1B	70.7895	-135.5662	419	20.83	1.32	0.83	0.24
ARA4C	32MUC1B	70.9849	-134.6047	260	21.13	1.32	1.13	0.52
ARA4C	37MUC1B	70.6338	-139.3676	1173	18.63	1.27	1.23	0.50
ARA4C	38MUCB	70.6534	-138.7913	1194	19.53	1.29	1.19	0.53
ARA4C	40MUC1B	70.1339	-138.7000	331	25.61	1.41	1.13	0.39
ARA4C	43MUC2B	69.9710	-137.2299	57	25.66	1.41	1.09	0.50
ARA5B	01BOXB	70.7890	-135.5675	420	15.90	1.20	0.90	0.39
ARA5B	02BOXB	70.7058	-135.5675	410	19.60	1.29	1.10	0.31
ARA5B	10BOXB	70.6495	-135.9458	277	21.73	1.34	1.31	0.49
ARA5B	17BOXB	70.8567	-136.2112	848	18.58	1.27	1.13	0.52
ARA5B	18BOXB	70.8018	-136.0977	740	19.54	1.29	1.17	0.49
ARA5B	33BOXB	70.7552	-134.1577		18.30	1.26	1.19	0.51
ARA5B	34BOXB	70.6045	-134.8036		22.64	1.35	1.16	0.51

Supplementary table 2. The quartz/feldspar (Q/S) and Q/S with logarithmic function ( $\log Q/S$ ) of bulk fraction, and (chlorite + kaolinite)/illite (CK/I) and chlorite/illite (C/I) ratios of clay fraction in the core ARA02B 01A-GC.

Leg	Core	Depth (cm)	Age (ka) $\Delta R=500$	log			
				Q/F	Q/F	CK/I	C/I
ARA02B	01-GC	0	0.00	8.00	0.90	1.04	0.60
ARA02B	01-GC	5	0.14	8.75	0.94	1.22	0.64
ARA02B	01-GC	10	0.28	6.45	0.81	1.20	0.69
ARA02B	01-GC	15	0.43	7.62	0.88	1.14	0.54
ARA02B	01-GC	20	0.57	8.19	0.91	1.13	0.75
ARA02B	01-GC	25	0.71	8.66	0.94	1.35	0.70
ARA02B	01-GC	30	0.85	9.87	0.99	1.21	0.64
ARA02B	01-GC	35	1.00	7.62	0.88	1.21	0.66
ARA02B	01-GC	40	1.14	9.61	0.98	1.21	0.65
ARA02B	01-GC	45	1.28	8.23	0.92	1.19	0.68
ARA02B	01-GC	50	1.42	8.43	0.93	1.23	0.67
ARA02B	01-GC	55	1.56	9.01	0.95	1.20	0.68
ARA02B	01-GC	60	1.71	8.10	0.91	1.13	0.55
ARA02B	01-GC	65	1.85	8.54	0.93	1.19	0.63
ARA02B	01-GC	70	1.99	8.94	0.95	1.14	0.61
ARA02B	01-GC	75	2.13	8.74	0.94	1.24	0.71
ARA02B	01-GC	80	2.27	10.58	1.02	1.24	0.72
ARA02B	01-GC	85	2.42	8.48	0.93	1.12	0.53
ARA02B	01-GC	90	2.56	8.31	0.92	1.16	0.67
ARA02B	01-GC	95	2.70	8.99	0.95	1.01	0.58
ARA02B	01-GC	100	2.84	8.11	0.91	1.19	0.71
ARA02B	01-GC	105	2.99	8.42	0.93	1.07	0.60
ARA02B	01-GC	110	3.09	7.94	0.90	1.16	0.63
ARA02B	01-GC	115	3.17	10.22	1.01	1.23	0.77
ARA02B	01-GC	120	3.25	9.62	0.98	1.25	0.71
ARA02B	01-GC	125	3.32	9.38	0.97	1.12	0.60

ARA02B	01-GC	130	3.40	9.44	0.97	1.17	0.70
ARA02B	01-GC	135	3.47	8.61	0.93	1.16	0.69
ARA02B	01-GC	140	3.55	9.14	0.96	1.29	0.71
ARA02B	01-GC	145	3.62	9.68	0.99	1.17	0.66
ARA02B	01-GC	150	3.70	9.07	0.96	1.28	0.79
ARA02B	01-GC	155	3.77	9.74	0.99	1.23	0.69
ARA02B	01-GC	160	3.85	8.57	0.93	1.32	0.73
ARA02B	01-GC	165	3.92	8.89	0.95	1.12	0.75
ARA02B	01-GC	170	3.99	9.73	0.99	1.31	0.73
ARA02B	01-GC	175	4.06	9.52	0.98	1.28	0.74
ARA02B	01-GC	180	4.13	10.27	1.01	1.16	0.70
ARA02B	01-GC	185	4.20	9.19	0.96	1.11	0.69
ARA02B	01-GC	190	4.28	10.09	1.00	1.21	0.79
ARA02B	01-GC	195	4.35	9.18	0.96	1.11	0.74
ARA02B	01-GC	200	4.42	8.89	0.95	1.27	0.67
ARA02B	01-GC	205	4.49	10.93	1.04	1.29	0.79
ARA02B	01-GC	210	4.54	9.37	0.97	1.16	0.72
ARA02B	01-GC	215	4.60	9.46	0.98	1.22	0.65
ARA02B	01-GC	221	4.65	8.78	0.94	1.21	0.73
ARA02B	01-GC	225	4.71	9.34	0.97	1.10	0.60
ARA02B	01-GC	230	4.76	10.15	1.01	1.12	0.66
ARA02B	01-GC	235	4.82	8.63	0.94	1.12	0.74
ARA02B	01-GC	240	4.88	8.23	0.92	1.23	0.68
ARA02B	01-GC	245	4.93	8.03	0.90	1.16	0.71
ARA02B	01-GC	250	4.98	9.49	0.98	1.14	0.63
ARA02B	01-GC	255	5.03	8.01	0.90	1.25	0.64
ARA02B	01-GC	260	5.08	9.39	0.97	1.29	0.69
ARA02B	01-GC	265	5.14	8.11	0.91	1.27	0.67
ARA02B	01-GC	270	5.19	8.47	0.93	1.25	0.71
ARA02B	01-GC	275	5.24	9.72	0.99	1.22	0.68
ARA02B	01-GC	280	5.29	10.14	1.01	1.20	0.72
ARA02B	01-GC	285	5.34	8.42	0.93	1.05	0.64

ARA02B	01-GC	290	5.39	10.17	1.01	1.17	0.68
ARA02B	01-GC	295	5.45	9.31	0.97	1.16	0.64
ARA02B	01-GC	300	5.50	8.90	0.95	1.13	0.61
ARA02B	01-GC	305	5.55	8.84	0.95	1.21	0.65
ARA02B	01-GC	310	5.60	9.00	0.95	1.30	0.68
ARA02B	01-GC	315	5.65	10.96	1.04	1.14	0.67
ARA02B	01-GC	320	5.71	10.93	1.04	1.18	0.69
ARA02B	01-GC	325	5.76	10.30	1.01	1.26	0.67
ARA02B	01-GC	330	5.81	11.04	1.04	1.18	0.69
ARA02B	01-GC	335	5.86	10.37	1.02	1.19	0.69
ARA02B	01-GC	340	5.91	10.94	1.04	1.15	0.69
ARA02B	01-GC	345	5.96	10.98	1.04	1.15	0.63
ARA02B	01-GC	350	6.03	11.15	1.05	1.13	0.64
ARA02B	01-GC	355	6.10	10.67	1.03	1.13	0.69
ARA02B	01-GC	360	6.18	10.60	1.03	1.04	0.62
ARA02B	01-GC	365	6.26	11.48	1.06	1.23	0.73
ARA02B	01-GC	370	6.33	9.42	0.97	1.31	0.77
ARA02B	01-GC	375	6.41	11.50	1.06	1.22	0.72
ARA02B	01-GC	380	6.48	10.59	1.02	1.08	0.69
ARA02B	01-GC	385	6.56	7.68	0.89	1.14	0.63
ARA02B	01-GC	390	6.64	10.27	1.01	1.18	0.61
ARA02B	01-GC	395	6.71	9.53	0.98	1.16	0.67
ARA02B	01-GC	400	6.79	11.28	1.05	1.15	0.70
ARA02B	01-GC	405	6.86	9.67	0.99	1.21	0.67
ARA02B	01-GC	410	6.94	11.39	1.06	1.18	0.67
ARA02B	01-GC	415	7.01	12.02	1.08	1.19	0.62
ARA02B	01-GC	420	7.09	10.75	1.03	1.20	0.66
ARA02B	01-GC	425	7.17	10.86	1.04	1.20	0.68
ARA02B	01-GC	430	7.24	11.37	1.06	1.05	0.66
ARA02B	01-GC	435	7.32	9.71	0.99	1.16	0.66
ARA02B	01-GC	440	7.39	10.10	1.00	1.20	0.65
ARA02B	01-GC	445	7.47	9.44	0.98	1.17	0.68

ARA02B	01-GC	450	7.55	11.33	1.05	1.20	0.71
ARA02B	01-GC	455	7.62	9.78	0.99	1.16	0.68
ARA02B	01-GC	460	7.71	9.81	0.99	1.19	0.60
ARA02B	01-GC	465	7.80	12.81	1.11	1.10	0.70
ARA02B	01-GC	470	7.90	10.44	1.02	1.13	0.65
ARA02B	01-GC	475	7.99	14.79	1.17	1.28	0.69
ARA02B	01-GC	480	8.09	11.85	1.07	1.22	0.69
ARA02B	01-GC	485	8.18	10.87	1.04	1.15	0.64
ARA02B	01-GC	490	8.27	12.61	1.10	1.15	0.69
ARA02B	01-GC	495	8.37	10.42	1.02	1.19	0.60
ARA02B	01-GC	500	8.46	10.86	1.04	1.12	0.66
ARA02B	01-GC	505	8.56	12.88	1.11	1.23	0.58
ARA02B	01-GC	510	8.65	10.80	1.03	1.14	0.61
ARA02B	01-GC	515	8.75	12.90	1.11	1.15	0.73
ARA02B	01-GC	520	8.84	13.25	1.12	1.11	0.52
ARA02B	01-GC	525	8.93	14.60	1.16	1.26	0.59
ARA02B	01-GC	530	9.03	17.39	1.24	1.07	0.56
ARA02B	01-GC	535	9.12	11.31	1.05	1.19	0.64
ARA02B	01-GC	540	9.22	13.50	1.13	1.12	0.68
ARA02B	01-GC	545	9.31	10.86	1.04	1.04	0.54

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Supplementary table 3. The quartz/feldspar (Q/S) and Q/S with logarithmic function (log Q/S), (chlorite + kaolinite)/illite (CK/I) and chlorite/illite (C/I) ratios of bulk fraction in the core HLY0501-5JPC/TC

Leg	Core	Age (kyr)		Q/F	log Q/F	CK/I	C/I
		Composite depth (cm)	$\Delta R=0$ (ka)				
HLY05-01	5TC	9	0.08	7.13	0.85	1.20	0.75
HLY05-01	5TC	25	0.33	6.32	0.80	1.23	0.77
HLY05-01	5TC	52	0.74	7.24	0.86	1.29	0.59
HLY05-01	5JPC	76	1.11	7.15	0.85	1.39	0.74
HLY05-01	5TC	100	1.48	8.22	0.92	1.42	0.78
HLY05-01	5JPC	136	1.73	8.22	0.92	1.19	0.66
HLY05-01	5TC	150	1.90	8.52	0.93	1.26	0.73
HLY05-01	5JPC	160	2.00	7.88	0.90	1.43	0.82
HLY05-01	5JPC	173	2.01	7.86	0.90	1.22	0.71
HLY05-01	5JPC	175	2.17	7.61	0.88	1.28	0.75
HLY05-01	5JPC	197	2.24	7.49	0.87	1.20	0.61
HLY05-01	5TC	200	2.34	7.87	0.90	1.40	0.71
HLY05-01	5JPC	221	2.36	8.12	0.91	1.42	0.80
HLY05-01	5JPC	223	2.57	6.73	0.83	1.25	0.79
HLY05-01	5TC	248	2.80	8.44	0.93	1.30	0.78
HLY05-01	5JPC	253	3.01	6.73	0.83	1.25	0.79
HLY05-01	5JPC	285	3.20	9.29	0.97	1.36	0.87
HLY05-01	5JPC	342	3.55	7.72	0.89	1.32	0.70
HLY05-01	5JPC	392	3.60	7.79	0.89	1.22	0.62
HLY05-01	5JPC	398	3.74	9.30	0.97	1.20	0.82
HLY05-01	5JPC	462	4.05	9.23	0.97	1.42	0.87
HLY05-01	5JPC	523	4.48	10.09	1.00	1.45	0.91
HLY05-01	5JPC	575	4.81	7.65	0.88	1.28	0.73
HLY05-01	5JPC	611	5.00	8.01	0.90	1.30	0.73
HLY05-01	5JPC	630	5.08	7.98	0.90	1.27	0.59

HLY05-01	5JPC	680	5.30	9.46	0.98	1.34	0.80
HLY05-01	5JPC	775	5.73	9.22	0.96	1.33	0.80
HLY05-01	5JPC	823	6.04	9.28	0.97	1.34	0.76
HLY05-01	5JPC	855	6.25	8.47	0.93	1.26	0.64
HLY05-01	5JPC	951	6.93	10.23	1.01	1.44	0.81
HLY05-01	5JPC	975	7.10	8.27	0.92	1.17	0.75
HLY05-01	5JPC	978	7.12	11.43	1.06	1.24	0.73
HLY05-01	5JPC	1023	7.43	10.29	1.01	1.37	0.84
HLY05-01	5JPC	1055	7.66	9.96	1.00	1.08	0.69
HLY05-01	5JPC	1096	7.94	11.38	1.06	1.31	0.83
HLY05-01	5JPC	1098	7.96	9.67	0.99	1.16	0.83
HLY05-01	5JPC	1120	8.11	7.53	0.88	1.33	0.85
HLY05-01	5JPC	1144	8.28	10.77	1.03	1.27	0.77
HLY05-01	5JPC	1192	8.62	13.96	1.15	1.14	0.62
HLY05-01	5JPC	1215	8.79	11.19	1.05	1.26	0.76
HLY05-01	5JPC	1238	8.95	12.94	1.11	1.10	0.65
HLY05-01	5JPC	1262	9.12	10.36	1.02	1.23	0.75
HLY05-01	5JPC	1286	9.29	11.95	1.08	1.26	0.78
HLY05-01	5JPC	1310	9.46	10.33	1.01	1.31	0.82
HLY05-01	5JPC	1353	10.98	10.00	1.00	1.19	0.61
HLY05-01	5JPC	1376	11.85	23.13	1.36	1.34	0.78
HLY05-01	5JPC	1425	12.62	9.79	0.99	1.02	0.59
HLY05-01	5JPC	1522	13.93	14.48	1.16	1.22	0.80
HLY05-01	5JPC	1591	14.86	7.76	0.89	1.34	0.75
HLY05-01	5JPC	1610	15.12	7.79	0.89	1.44	0.88

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