

Table S1: Mineral compositions**1) Samples**

Thin section	Depth (feet)	Thin section	Depth (feet)
TS001	2334' 2"	TS005	2378' 0"
TS002	2344' 0"	TS006	2392' 8"
TS003	2359' 5"	TS007	2399' 6"
TS004	2364' 1"		

Calcites (Mole % normalised to 100)

	TS001		TS002	
	n = 18	1 σ	n = 19	1 σ
CaCO ₃	98.141	0.558	95.232	0.452
MgCO ₃	0.356	0.145	0.799	0.088
FeCO ₃	0.783	0.250	1.969	0.297
MnCO ₃	0.721	0.196	1.953	0.110
SrCO ₃ *	0.363	0.066	0.098	0.043
Total**	104.2	3.5	106.6	2.0

Plagioclase (8 Oxygens)

Point	TS001															
	70/1	69/1.	42/1.	43/1.	48/1.	68/1.	46/1.	50/1.	49/1.	47/1.	51/1.	53/1.	65/1.	66/1.	52/1.	63/1.
Si	2.883	2.705	2.766	2.831	2.777	2.906	2.788	2.865	2.849	2.736	2.877	2.822	2.910	2.928	2.886	2.923
Al	1.096	1.273	1.212	1.147	1.268	1.073	1.240	1.138	1.148	1.255	1.114	1.163	1.091	1.072	1.106	1.070
Ca	0.120	0.311	0.247	0.183	0.129	0.091	0.142	0.110	0.143	0.244	0.102	0.153	0.075	0.034	0.109	0.073
Na	0.862	0.713	0.723	0.823	0.758	0.893	0.788	0.873	0.830	0.743	0.809	0.773	0.881	0.946	0.868	0.923
K	0.052	0.020	0.053	0.031	0.034	0.054	0.010	0.017	0.039	0.026	0.085	0.077	0.044	0.026	0.024	0.009
Sr*																
An%	11.60	29.79	24.18	17.66	14.01	8.78	15.07	11.01	14.10	24.06	10.24	15.27	7.47	3.36	10.85	7.26
Total***	97.54	97.76	97.94	98.10	98.66	98.90	99.09	99.42	99.45	99.49	99.59	99.91	100.15	100.28	100.34	100.69

Plagioclase (8 Oxygens)

Point	TS004															
	20/1.	26/1.	23/1.	17/1.	15/1.	16/1.	28/1.	14/1.	27/1.	13/1.	25/1.	11/1.	5/1.	10/1.	9/1.	34/1.
Si	2.735	2.737	2.822	2.688	2.863	2.861	2.738	2.882	2.744	2.726	2.711	2.806	2.785	2.803	2.811	2.882
Al	1.238	1.266	1.155	1.282	1.117	1.121	1.242	1.103	1.243	1.257	1.268	1.182	1.203	1.181	1.176	1.106
Ca	0.267	0.247	0.183	0.339	0.136	0.134	0.273	0.112	0.273	0.286	0.301	0.189	0.203	0.189	0.187	0.110
Na	0.712	0.669	0.817	0.647	0.852	0.853	0.742	0.859	0.720	0.697	0.677	0.835	0.755	0.834	0.842	0.821
K	0.064	0.064	0.042	0.053	0.047	0.047	0.019	0.054	0.020	0.028	0.043	0.010	0.057	0.008	0.010	0.097
Sr*	0.012	0.004	0.007	0.003	0.008	0.008	0.002	0.007	0.001	0.003	0.004	0.001	0.009	0.000	0.000	0.000
An%	25.61	25.20	17.55	32.63	13.10	12.94	26.41	10.96	26.97	28.29	29.50	18.30	20.04	18.31	18.01	10.73
Total***	97.12	97.24	97.26	97.29	97.96	98.05	98.22	98.50	98.53	98.63	98.76	98.83	98.85	98.98	99.03	99.28

Table S1 (continued)

Plagioclase (8 Oxygens)									Plagioclase (8 Oxygens)						
	TS004 (continued)								TS006						
Point	3 / 1 .	2 / 1 .	40 / 1 .	1 / 1 .	37 / 1 .	39 / 1 .	33 / 1 .	38 / 1 .	95 / 1 .	84 / 1 .	93 / 1 .	90 / 1 .	85 / 1 .	91 / 1 .	96 / 1 .
Si	2.867	2.836	2.756	2.831	2.659	2.556	2.768	2.699	2.634	2.634	2.531	2.700	2.524	2.698	2.612
Al	1.125	1.153	1.241	1.156	1.328	1.436	1.237	1.305	1.353	1.355	1.456	1.294	1.464	1.295	1.372
Ca	0.118	0.174	0.245	0.165	0.338	0.439	0.231	0.290	0.376	0.366	0.474	0.298	0.478	0.303	0.383
Na	0.832	0.764	0.690	0.794	0.640	0.553	0.695	0.660	0.592	0.604	0.500	0.651	0.495	0.640	0.594
K	0.057	0.061	0.052	0.065	0.039	0.013	0.035	0.040	0.036	0.038	0.034	0.050	0.028	0.057	0.042
Sr*	0.006	0.006	0.001	0.007	0.002	0.005	0.003	0.000	0.002	0.003	0.003	0.002	0.003	0.002	0.005
An%	11.76	17.42	24.88	16.08	33.20	43.67	24.03	29.29	37.47	36.26	47.01	29.86	47.74	30.31	37.61
Na/Ca	7.03	4.39	2.81	4.82	1.90	1.26	3.01	2.27	1.57	1.65	1.06	2.18	1.04	2.11	1.55
Total***	99.48	99.68	99.73	99.89	100.07	100.37	100.89	101.87	98.23	99.51	99.63	99.63	99.68	99.79	99.81
Plagioclase (8 Oxygens)															
	TS006 (continued)														
Point	87 / 1 .	103 / 1 .	107 / 1 .	92 / 1 .	101 / 1 .	6 / 1 .	4 / 1 .	31 / 1 .	12 / 1 .	31 / 1 .					
Si	2.766	2.589	2.709	2.671	2.729	2.947	2.909	2.934	2.718	2.934					
Al	1.240	1.392	1.276	1.297	1.263	1.056	1.126	1.052	1.262	1.052					
Ca	0.217	0.417	0.302	0.313	0.270	0.034	0.028	0.059	0.285	0.059					
Na	0.708	0.558	0.658	0.657	0.688	0.959	0.906	0.971	0.710	0.971					
K	0.050	0.033	0.054	0.041	0.052	0.010	0.010	0.012	0.032	0.012					
Sr*	0.000	0.004	0.002	0.002	0.000	0.000	0.001	0.000	0.003	0.000					
An%	22.29	41.41	29.74	30.95	26.73	3.36	2.95	5.64	27.74	5.64					
	3.26	1.34	2.18	2.10	2.55	28.42	32.53	16.51	2.49	16.51					
Total***	99.83	99.90	99.91	100.69	101.11	97.57	97.82	99.06	97.70	99.06					
K-feldspar (8 Oxygens)															
	TS001	TS004	TS004	TS006	TS006										
	83 / 1 .	7 / 1 .	32 / 1 .	106 / 1 .	99 / 1 .										
Si	2.989	2.985	2.982	2.983	2.994										
Al	0.987	1.000	1.007	1.003	0.989										
Ca	0.001	0.000	0.001	0.001	0.000										
Na	0.048	0.056	0.021	0.026	0.312										
K	1.026	0.978	1.018	1.005	0.718										
Sr*	0.000	0.004	0.000	0.000	0.000										
Total***	97.08	98.92	100.16	100.27	100.73										

Table S1 (continued)

Micas[§] (22 oxygens)

	TS004	TS004	TS004	TS004	TS004	TS004	TS004	TS004	TS004	TS004	TS004	TS004	TS004	TS006	TS006	TS006
Point	135	137	140	132	141	134	133	143	142	138	128	129	139	125	115	114
Si	6.2642	6.6496	7.0243	6.4695	6.3904	6.4362	6.5346	6.3549	6.3409	6.2035	5.8967	4.8187	5.9225	6.3904	6.4606	7.4143
Al	6.1554	4.8489	4.3974	5.2900	5.6656	5.3691	5.2682	5.6632	5.7104	6.0726	3.3036	3.0881	5.5054	4.9596	4.4750	3.7082
Ti	0.0006	0.0090	0.0339	0.0143	0.0361	0.1096	0.0207	0.0342	0.0290	0.0310	0.2501	0.4617	0.0495	0.0821	0.0694	0.1464
Fe	0.1641	0.5833	0.4529	0.6152	0.3985	0.5209	0.5787	0.4636	0.4334	0.2771	2.9662	4.6543	1.5255	0.9303	0.8247	0.2976
Mn	0.0011	0.0022	0.0000	0.0012	0.0014	-0.0005	0.0007	0.0000	0.0000	0.0002	0.0165	0.0262	0.0077	-0.0002	0.0004	0.0023
Mg	0.0563	0.3330	0.3535	0.2083	0.1066	0.1926	0.2050	0.1224	0.1119	0.1002	1.0921	1.6970	0.1446	0.4066	0.6477	0.2367
Ca	0.0053	0.0684	0.0350	0.0235	0.0074	0.0183	0.0231	0.0090	0.0202	0.0082	0.0376	0.0357	0.0372	0.0429	0.0139	0.0364
Na	0.0173	0.2225	0.0780	0.1356	0.0997	0.0678	0.0939	0.1351	0.1202	0.0425	0.0905	0.0779	0.0701	0.1346	0.1426	0.5233
K	0.0045	0.6235	0.8151	0.3636	0.1705	0.1798	0.2659	0.1300	0.1413	0.0313	1.1874	0.7110	0.0967	0.3388	1.3398	0.9631
Total***	72.17	75.56	83.16	84.55	84.75	85.99	87.54	87.62	88.05	89.58	72.25	87.26	91.37	79.20	79.51	79.89
	TS006	TS006	TS006	TS006	TS006	TS006	TS006	TS006	TS006							
Point	120	119	111	121	117	113	123	122								
Si	6.504	6.527	7.342	6.044	4.763	5.410	5.012	5.074								
Al	5.070	4.787	3.231	4.129	3.884	3.708	3.404	4.516								
Ti	0.047	0.054	0.015	0.247	0.061	0.172	0.548	0.404								
Fe	0.628	0.889	1.121	1.742	4.560	1.790	3.429	2.539								
Mn	0.000	0.000	0.003	0.008	0.008	0.018	0.012	0.009								
Mg	0.364	0.412	0.607	0.907	1.704	2.509	1.828	1.496								
Ca	0.019	0.028	0.014	-0.002	0.115	0.000	0.002	0.004								
Na	0.215	0.229	0.361	0.092	0.111	0.113	0.095	0.082								
K	0.352	0.429	1.032	1.047	0.167	1.803	0.913	0.361								
Total***	83.04	83.65	86.97	74.65	86.83	91.96	92.33	94.32								

* Sr concentrations have large scatter resulting from counting statistics

** Total as sum of MCO₃

*** Total as sum of oxides

§ Micas mainly weathered and partially chloritised biotites

Table S1 Frontier Formation outcrop samples (continued)

Biotite 22 oxygens

	FR15_1	FR15_2	FR15_3	FR15_4	FR15_5	FR15_6	FR15_7	FR15_8	FR15_9	FR15_10	FR15_11	FR15_12	FR15_12	FR24_2	FR24_3	FR24_4
Point	1	2	3	4	5	6	7	8	9	10	11	12	12	2	3	4
Si	5.632	5.583	5.545	5.221	5.673	5.564	5.585	5.585	5.543	5.513	5.574	5.493	5.527	5.732	5.513	5.511
Ti	0.499	0.485	0.476	0.469	0.374	0.554	0.536	0.444	0.574	0.531	0.489	0.484	0.477	0.481	0.573	0.487
Al	2.537	2.480	2.465	2.788	3.257	2.475	2.439	2.487	2.419	2.423	2.664	2.506	2.460	2.946	2.481	2.496
Fe	2.407	2.697	2.939	3.327	2.436	2.564	2.166	2.416	2.549	3.273	2.369	2.702	2.672	2.846	2.289	3.013
Mn	0.017	0.037	0.049	0.029	0.037	0.019	0.019	0.037	0.025	0.024	0.019	0.043	0.040	0.019	0.016	0.044
Mg	2.622	2.463	2.357	2.510	1.785	2.529	2.904	2.821	2.597	2.028	2.593	2.619	2.658	1.465	2.938	2.318
Ca	0.044	0.076	0.015	0.096	0.029	0.047	0.032	0.023	0.018	0.014	0.076	0.013	0.017	0.014	0.024	0.022
Na	0.089	0.094	0.083	0.071	0.090	0.107	0.147	0.113	0.149	0.126	0.157	0.096	0.089	0.149	0.119	0.093
K	1.597	1.649	1.721	0.881	1.375	1.680	1.810	1.714	1.747	1.754	1.486	1.727	1.738	1.471	1.558	1.630
F	0.080	0.084	0.122	0.063	0.147	0.148	1.061	0.176	0.704	0.183	0.055	0.129	0.108	0.923	0.062	0.109
Total***	93.70	94.13	96.10	89.13	94.04	94.57	96.76	96.36	99.09	95.76	94.63	95.68	96.29	96.47	93.56	92.36

Biotite 22 oxygens

	FR24_5	FR24_6	FR24_8	FR24_8	FR24_10	FR24_11	FR24_12	FR24_12	FR29_1	FR29_1	FR29_2	FR29_3	FR29_4	FR29_4	FR29_5	FR29_6
Point	5	6	8	8	10	10	10	10	1	1	2	3	4	4	5	6
Si	5.630	5.525	5.560	5.350	5.539	6.475	5.524	5.524	5.529	5.692	5.586	5.758	5.654	5.594	5.594	5.560
Ti	0.475	0.578	0.384	0.397	0.504	0.243	0.478	0.472	0.376	0.415	0.383	0.550	0.460	0.468	0.522	0.504
Al	2.417	2.532	3.017	2.975	2.474	4.174	2.523	2.509	2.833	2.562	2.771	2.498	2.519	2.491	2.571	2.461
Fe	2.876	2.038	3.313	3.632	3.026	5.304	2.851	2.877	3.121	2.978	2.251	2.146	2.486	2.625	2.353	3.633
Mn	0.046	0.010	0.033	0.039	0.048	0.030	0.046	0.044	0.024	0.025	0.020	0.020	0.036	0.037	0.015	0.035
Mg	2.274	3.150	1.513	1.760	2.147	2.585	2.433	2.411	2.043	2.093	2.968	2.621	2.635	2.615	2.609	1.544
Ca	0.009	0.021	0.037	0.042	0.007	0.065	0.024	0.022	0.040	0.037	0.027	0.047	0.041	0.035	0.013	0.028
Na	0.109	0.111	0.075	0.064	0.106	0.046	0.127	0.115	0.024	0.004	0.057	0.063	0.091	0.101	0.171	0.171
K	1.810	1.442	1.308	1.077	1.848	0.592	1.590	1.665	1.405	1.616	1.224	1.545	1.502	1.555	1.671	1.707
F	0.105	0.102	0.225	0.181	0.120	0.134	0.099	0.090	0.061	0.046	0.064	0.070	0.302	0.198	0.051	0.178
Total***	95.54	96.68	91.77	89.97	93.87	90.41	94.90	95.28	82.64	86.44	83.59	91.29	94.83	93.97	94.08	95.02

*** Total as sum of oxides

Table S1 (continued)

Biotite 22 oxygens

	FR29_7	FR29_8
Point	6	8
Si	5.984	5.590
Ti	0.288	0.473
Al	4.308	2.474
Fe	1.360	2.915
Mn	0.019	0.038
Mg	1.172	2.260
Ca	0.029	0.002
Na	0.043	0.105
K	0.783	1.793
F	0.024	0.225

Total*** 91.39 96.67

Chlorite 28 oxygens

	FR24_1	FR24_7	FR24_9	FR24_9
Point	1	7	9	9
Si	6.501	6.288	6.434	6.623
Ti	0.518	0.481	0.555	0.570
Al	3.848	4.195	4.042	3.857
Fe	4.765	4.959	4.617	4.266
Mn	0.038	0.018	0.020	0.028
Mg	2.880	2.928	3.039	3.120
Ca	0.094	0.051	0.038	0.042
Na	0.049	0.065	0.035	0.054
K	0.777	0.361	0.456	0.693
F	0.075	0.098	0.089	0.135

Total*** 75.59 86.21 88.19 85.53

Kaolinite 14 oxygens

FR15_5
5
3.990
0.012
3.840
0.138
0.002
0.069
0.015
0.004
0.023
0.002

85.86

*** Total as sum of oxides

Table S2: Water analyses

Well 16WC2NW05

Date	Day*	Na	K	Ca	Mg	Si	Sr	Cl	Br	F	SO ₄	Al	Fe	Mn	⁸⁷ Sr/ ⁸⁶ Sr	Alkalinity meq
		----- mmolar -----				--- μmolar ---		mmolar		----- μmolar -----						
15/09/2010	2.4	105.9	0.660	5.23	1.67	595.8	67.1	47.4	59.88	34.45	74.56	3.35	1.07	12.50	0.711322	
16/09/2010	3.5	104.9	0.642	5.29	1.65	606.1	67.8	47.6	64.55	33.61	74.54	2.14	1.32	12.58	0.711344	75.66
17/09/2010	4.4	103.8	0.635	5.24	1.64	600.2	67.3	47.5	62.80	31.94	69.91	3.46	1.46	12.57		
18/09/2010	5.5	106.4	0.670	5.40	1.71	606.5	68.9	47.4	64.88	34.63	89.52	2.86	1.17	13.22		
19/09/2010	6.5	105.5	0.645	5.46	1.73	625.8	70.1	48.3	63.93	29.30	129.97	4.15	1.62	13.53	0.711293	
20/09/2010	7.4	105.4	0.649	5.38	1.73	620.1	69.6	48.3	63.78	31.13	106.95	2.26	-0.04	13.38		
21/09/2010	8.4	107.1	0.673	5.48	1.78	623.9	70.4	47.4	64.01	28.24	91.06	2.83	0.19	13.76	0.711370	
23/09/2010	10	120.5	0.699	4.70	1.68	614.5	81.5	54.1	79.42	26.30		2.09	0.43	13.97		83.94
28/09/2010	15	109.9	0.694	5.70	1.99	656.1	77.5	47.3	62.55	26.90	227.28	2.74	0.87	15.20		
28/09/2010	16	112.2	0.702	6.18	2.15	679.7	79.2	47.8	63.79	23.22	95.41	2.19	0.23	17.88		88.77
01/10/2010	16	109.6	0.671	5.79	2.07	651.3	76.7	48.1	64.32	32.39	132.75	1.57	1.90	16.56		
02/10/2010	17	111.9	0.705	4.04	2.13	659.5	68.1	47.5	62.08	20.14	88.63	2.76	1.01	8.21	0.711213	81.02
04/10/2010	19	108.2	0.684	5.57	1.98	639.5	75.3	47.4	63.89	22.92	93.00	4.27	2.37	15.81	0.711093	89.87
05/10/2010	20	109.6	0.674	5.63	1.97	641.4	75.8	47.5	62.55	26.64	86.92	2.02	5.30	16.39		83.03
07/10/2010	22														0.711183	83.59
08/10/2010	23	111.6	0.704	5.82	2.04	661.6	79.1	48.0	66.22	28.49	86.47	3.06	50.29	16.76	0.710944	84.87
09/10/2010	24	113.1	0.682	5.91	2.03	670.5	79.9	48.6	64.57	23.86	102.06	2.42	2.46	16.57		83.74
10/10/2010	25	111.2	0.667	5.86	1.99	662.7	79.1	48.4	63.74	26.45	92.89	1.25	29.18	16.32	0.710940	88.08
11/10/2010	26	110.0	0.680	6.10	1.99	675.1	80.8	48.7	64.79	27.19	80.10	3.30	49.65	16.66		83.89
12/10/2010	27	114.3	0.684	6.07	2.04	684.2	81.9	49.1	64.90	27.63	116.76	2.58	35.87	16.93	0.710838	
14/10/2010	29	121.0	0.749	6.56	2.17	728.2	88.0	51.5	66.26	27.84	92.29	5.03	63.57	18.27	0.710747	
16/10/2010	31	137.6	0.835	7.45	2.40	824.9	99.7	60.0	79.16	30.46	101.35	4.33	35.49	20.03	0.710693	
17/10/2010	32	126.6	0.775	6.96	2.26	781.2	93.0	54.3	70.60	27.78	92.17	4.93	71.54	19.19	0.710689	97.19
09/11/2010	55							46.8	61.03	18.61	119.39				0.710359	105.04
05/02/2011	145	126.5	0.880	7.79	3.21	807.6	114.5	49.7	66.03	9.35	110.59	4.85	1.58	25.49	0.710964	104.86
07/02/2011	147	125.5	0.875	6.70	3.20	698.5	107.3	47.3	64.69	12.96	91.08	4.17	19.01	20.72		102.57
08/02/2011	148	126.2	0.880	6.23	3.18	591.2	102.4	47.6	63.70	12.62	130.66	4.16	0.82	19.93	0.710975	102.24
09/02/2011	149	126.6	0.884	5.91	3.19	504.6	99.7	47.5	62.85	13.96	97.15	4.73	0.55	18.13		102.86
10/02/2011	150	126.3	0.878	7.21	3.22	637.5	112.7	47.3	63.94	13.37	108.81	3.88	1.96	24.44		103.82
12/02/2011	152	132.3	0.928	3.01	3.07	828.5	74.3	43.1	69.03	26.83	24.35	3.47	0.54	4.69	0.711074	97.78
13/02/2011	153	133.4	0.928	5.29	3.34	849.1	99.8	51.2	68.37	11.01	84.45	4.51	0.71	10.62		105.26

Table S2: Continued

Well 18WC2NW05

Date	Day*	Na	K	Ca	Mg	Si	Sr	Cl	Br	F	SO ₄	Al	Fe	Mn	⁸⁷ Sr/ ⁸⁶ Sr	δ ¹⁸ O ‰ (VSMOW)	δD	Alkalinity meq
		----- mmolar				----- μmolar		----- mmolar		----- μmolar								
14/09/2010	1	96.7	0.768	5.11	1.88	652.6	65.7	49.2	67.65	60.65	26.39	3.16	0.79	3.77	0.713585	-17.81	-136.1	62.13
17/09/2010	4	96.5	0.770	5.05	1.87	648.5	65.6	49.0	67.57	63.35	25.91	2.96	1.57	3.66	0.713622	-17.73	-135.3	62.06
18/09/2010	5	95.1	0.750	4.93	1.82	644.9	65.1	50.3		67.04	25.21	2.62	0.07	3.59	0.713646	-17.78	-135.7	58.99
19/09/2010	6														0.713635			
20/09/2010	7	96.9	0.777	4.93	1.86	652.9	65.5	48.0	68.14	69.54	22.62	2.95	0.47	3.53	0.713662	-17.81	-135.8	63.15
21/09/2010	8	94.5	0.745	4.77	1.79	639.8	64.0	49.4	69.86	70.73	20.30	2.52	0.00	3.39	0.713684	-17.79	-136.0	58.97
23/09/2010	10	99.1	0.780	4.87	1.88	656.0	66.7	50.3	69.88	73.67	21.17	3.36	0.45	3.67	0.713559	-17.82	-135.6	62.94
26/09/2010	13	101.2	0.782	4.90	1.94	662.5	69.4	50.0	69.53	71.65	25.26	2.47	0.24	3.95	0.713409	-17.65	-135.6	65.65
27/09/2010	14	100.2	0.764	4.88	1.91	657.5	69.1	49.9	66.22	65.35	0.00	2.76	0.09	3.90		-17.64	-135.6	64.65
28/09/2010	15	101.9	0.789	4.96	1.98	668.6	70.4	48.9	70.62	62.66	23.63	1.89	0.72	3.92	0.713401	-17.61	-135.4	67.56
01/10/2010	18	99.9	0.764	5.00	1.96	667.1	70.8	49.9	68.50	54.09	21.73	3.64	1.82	3.96		-17.27	-133.8	64.70
02/10/2010	19	101.5	0.790	5.00	2.01	674.7	71.3	48.9	66.89	60.73	24.89	3.11	1.35	3.91	0.713492	-17.41	-134.4	67.38
04/10/2010	21	95.7	0.752	4.75	1.92	658.5	69.1	49.0	68.82	58.73	21.85	4.22	34.98	3.69		-17.40	-134.5	76.68
05/10/2010	22	100.0	0.781	4.85	1.98	671.5	70.0	50.2	68.64	59.17	23.10	5.29	34.74	3.72	0.713560	-17.36	-134.5	72.82
07/10/2010	24	98.2	0.757	4.74	1.93	665.6	69.0	50.3	69.04	64.41	20.12	4.51	35.06	3.62		-17.45	-134.6	71.52
08/10/2010	25	98.7	0.774	4.75	1.97	664.6	68.9	49.4	69.03	59.77	20.60	5.66	32.87	3.61	0.713631	-17.53	-134.7	72.75
09/10/2010	26	97.9	0.754	4.71	1.93	658.7	68.4	47.9	67.64	75.41	23.28	2.28	2.09	3.58		-17.59	-134.7	
11/10/2010	28	99.6	0.781	4.85	2.01	673.7	70.3	50.3	70.75	61.07	17.18	5.71	33.50	3.68	0.713695	0.00	0.0	73.84
13/10/2010	30	96.3	0.762	4.84	2.00	673.2	70.5	47.2	65.25	47.36	26.98	4.21	35.64	3.57		-17.52	-134.1	69.45
14/10/2010	31	99.5	0.782	4.97	2.05	682.7	71.2	50.9	72.13	56.41	26.49	5.06	36.07	3.62	0.713762	-17.61	-134.5	72.98
15/10/2010	32	99.0	0.767	5.01	2.03	681.6	71.6	48.6		62.30	27.27	5.06	37.10	3.65		-17.61	-134.4	76.00
17/10/2010	34/1	98.0	0.776	5.14	2.09	687.9	73.6	49.5	67.63	51.02	26.90	4.46	36.74	3.64	0.713802	-17.62	-134.2	77.01
17/10/2010	34/2	97.2	0.770	5.18	2.10	681.9	73.6	49.7	67.51	52.91	23.51	1.92	1.04	3.69		-17.64	-134.5	
19/10/2010	36	98.8	0.787	5.32	2.15	698.4	75.5	49.7	68.44	52.52	31.48	4.25	39.48	3.69		-17.76	-134.7	78.45
20/10/2010	37	98.4	0.781	5.35	2.16	699.1	75.6	49.6	69.55	56.84	33.68	4.26	36.66	3.69	0.713866	-17.66	-134.5	73.92
23/10/2010	40	98.2	0.781	5.51	2.19	696.5	76.6	49.1	68.95	51.36	24.61	3.61	33.89	3.76	0.713902			78.77
25/10/2010	42	102.5	0.846	5.61	2.22	703.7	77.7					6.30	39.96	3.83		-17.51	-133.8	77.15
26/10/2010	43	98.7	0.788	5.62	2.23	702.6	77.5	48.4	68.50	60.17	24.47	4.85	40.66	3.73	0.713941	-17.63	-134.4	75.83
27/10/2010	44	98.2	0.786	5.61	2.22	696.8	77.1	49.8	69.35	48.82	27.09	2.62	11.88	3.76		-17.66	-134.3	79.99
28/10/2010	45	100.5	0.807	5.76	2.28	714.0	79.1	49.1	68.45	60.46	26.20	4.55	10.49	3.88		-17.57	-134.2	75.75
30/10/2010	47	100.6	0.812	5.89	2.32	724.2	80.7	48.6	68.81	56.90	28.97	4.06	51.49	4.20	0.713911	-17.70	-133.3	78.07
02/11/2010	50	104.7	0.833	6.66	2.52	756.0	90.0	47.7	68.90	50.84	35.42	1.80	53.13	5.45		-17.55	-133.5	86.60
03/11/2010	51	103.4	0.835	6.37	2.44	749.3	86.6	48.5	69.14	53.02	30.43	3.97	48.13	4.73	0.713815	-17.60	-133.7	85.29
04/11/2010	52	102.2	0.828	6.33	2.44	742.2	85.6	47.9	67.40	50.74	29.83	2.70	36.46	4.59				80.90

Table S2: Continued
Well 18WC2NW05 (continued)

Date	Day*	Na	K	Ca	Mg	Si	Sr	Cl	Br	F	SO ₄	Al	Fe	Mn	⁸⁷ Sr/ ⁸⁶ Sr	δ ¹⁸ O	δD	Alkalinity
		----- mmolar -----				--- μmolar ---		mmolar		----- μmolar -----						‰ (VSMOW)		meq
11/11/2010	59	108.2	0.920	6.74	2.65	769.5	91.6	49.0	70.14	51.10	28.19	5.80	55.31	5.18		-17.57	-133.3	81.10
17/11/2010	65	102.7	0.840	7.05	2.67	746.4	92.9	45.5	64.49	43.95	28.33	3.19	46.47	5.33	0.713676	-17.59	-133.7	85.42
18/11/2010	66							50.5	69.44	47.77	31.74					-17.76	-133.8	81.77
19/11/2010	67	104.4	0.858	7.12	2.67	759.4	93.4	49.1	67.08	45.03	36.73	3.40	2.78	5.22		-17.71	-134.1	80.93
21/11/2010	69	104.2	0.855	7.13	2.70	759.7	93.9	48.0	70.26	45.76	37.67	5.02	55.71	5.31	0.713686	-17.88	-134.0	82.83
23/11/2010	71	104.4	0.855	7.13	2.70	763.3	94.9	48.8	70.05	47.01	34.05	5.04	59.93	5.49	0.713636	-18.03	-133.2	86.17
25/11/2010	73	107.1	0.857	7.11	2.68	764.3	96.3	51.4	70.34	42.18	36.93	4.32	55.36	5.97		-18.00	-133.4	85.99
27/11/2010	75	108.5	0.855	7.09	2.70	763.9	96.9	46.3	64.30	36.73	31.48	5.82	55.23	6.07		-18.16	-133.3	89.94
29/11/2010	77	108.0	0.847	6.98	2.68	753.8	96.7	54.1	78.46	48.69	29.58	4.95	56.20	6.08		-17.93	-132.2	87.97
30/11/2010	78	109.6	0.845	6.93	2.69	759.0	96.2	48.9	70.31	43.94	25.91	5.61	57.83	6.25	0.713304	-17.98	-132.6	87.91
04/02/2011	144	123.5	0.989	8.30	3.22	825.1	116.8					5.02	80.16	9.22	0.713052	0.00		106.07
05/02/2011	145	121.3	0.984	7.90	3.12	810.4	112.4	49.9	71.38	36.94	37.36	5.57	81.13	8.42		-18.03	-132.6	103.17
06/02/2011	146	120.5	0.984	7.34	3.05	808.3	107.9	47.2	67.54	30.99	20.69	5.12	55.19	7.36		-17.94	-133.0	98.56
07/02/2011	147	122.1	0.987	7.98	3.14	813.2	113.9	46.9	72.58	32.48	22.65	6.48	69.21	8.75		-18.08	-132.6	104.64
08/02/2011	148	120.9	0.980	7.78	3.08	802.6	110.8	46.7	67.51	34.53	21.06	5.88	72.60	8.45	0.713132	-18.23	-133.8	103.41
09/02/2011	149	120.6	0.981	7.74	3.07	805.0	110.4	48.1	68.54	36.37	20.46	5.68	70.22	8.38		-18.12	-133.3	104.30
10/02/2011	150	121.9	0.987	8.14	3.15	834.4	113.4	47.6	71.21	36.20	27.80	6.33	82.71	8.74		-17.97	-133.4	106.02
11/02/2011	151	120.4	0.978	7.70	3.03	800.8	109.4	50.8	75.39	37.57	20.07	5.59	48.05	8.21		-18.24	-133.8	101.77
12/02/2011	152	121.0	0.976	7.74	3.06	800.0	110.7	47.8	64.26	34.18	22.25	4.70	56.03	8.58		-18.10	-133.8	103.85
13/02/2011	153	122.6	0.983	7.86	3.09	806.6	112.4	47.8	66.88	34.69	21.66	4.96	52.22	8.69		-18.11	-133.5	

Well 28WC2NW05

14/09/2010	1	87.0	0.552	1.59	0.85	455.7	37.0	45.1	65.55	61.05	15.35	3.30	0.61	1.17	0.711384	-17.51	-135.3	47.21
15/09/2010	2	85.7	0.536	1.61	0.84	496.7	37.7	44.8	65.40	58.78	38.24	2.15	0.77	1.24	0.711373	-17.47	-135.2	46.20
17/09/2010	4	87.1	0.552	1.60	0.86	453.2	37.0	44.7	65.90	58.28	31.47	2.50	0.56	1.20		-17.45	-134.8	47.73
18/09/2010	5	85.9	0.538	1.62	0.85	496.7	38.0	46.9	67.12	61.76	24.84	1.74	0.68	1.27		-17.52	-135.7	44.38
20/09/2010	7	89.1	0.564	1.65	0.88	469.8	38.0	46.1	67.12	60.37	21.08	2.73	0.58	1.34		-17.52	-135.6	48.54
21/09/2010	8	87.2	0.546	1.66	0.86	503.3	38.7	48.6	71.45	63.97	30.32	2.59	0.59	1.34		-17.68	-136.4	44.09
23/09/2010	10	89.2	0.565	1.67	0.88	466.9	38.2	45.8	65.81	59.10	27.16	2.69	0.69	1.36	0.711413	-17.68	-136.2	49.00
26/09/2010	13	89.6	0.569	1.69	0.89	469.2	38.6	46.1	65.41	59.57	31.58	2.87	0.53	1.35		-17.64	-136.3	49.10
27/09/2010	14	85.9	0.538	1.66	0.86	493.9	38.5	46.4	67.68	59.91	36.13	3.72	0.71	1.31		-17.53	-134.5	44.98
28/09/2010	15	90.1	0.572	1.70	0.90	470.2	38.9	47.2	68.56	60.85	36.43	2.70	0.68	1.34		-17.85	-136.4	48.64
01/10/2010	18	85.1	0.563	1.64	0.86	497.4	38.4	45.6	64.91	58.30	29.41	5.41	1.63	1.37		-17.36	-133.8	44.97
02/10/2010	19	88.1	0.558	1.67	0.88	458.3	38.1	46.1	67.08	60.43	22.81	3.13	0.69	1.38	0.711415	-17.54	-135.6	53.28

Table S2: Continued

Well 28WC2NW05 (continued)

Date	Day*	Na	K	Ca	Mg	Si	Sr	Cl	Br	F	SO ₄	Al	Fe	Mn	⁸⁷ Sr/ ⁸⁶ Sr	δ ¹⁸ O	δD	Alkalinity
		----- mmolar -----				--- μmolar ---				----- μmolar -----				‰ (VSMOW)			meq	
04/10/2010	21	85.0	0.544	1.65	0.86	493.3	37.6	46.8	67.16	60.72	25.89	1.61	3.24	1.33		-17.53	-135.6	60.55
05/10/2010	22	86.8	0.551	1.65	0.87	451.2	37.6	44.6	63.12	58.02	22.83	1.84	3.30	1.32		-17.44	-135.5	53.74
07/10/2010	24	87.2	0.553	1.69	0.88	496.9	39.1	45.8	65.70	58.66	24.98	2.54	3.67	1.35		-17.54	-135.7	55.64
08/10/2010	25	88.8	0.565	1.69	0.90	458.6	38.7	47.5	66.91	60.07	36.64	3.29	2.77	1.36	0.711460	-17.71	-135.9	52.85
09/10/2010	26	86.3	0.541	1.69	0.87	495.1	39.1	46.2	65.09	58.59	23.87	3.45	0.95	1.35		-17.79	-136.5	
11/10/2010	28	87.9	0.567	1.68	0.89	453.9	38.4	44.1	61.17	55.89	22.59	2.68	2.70	1.35		-17.73	-136.3	56.76
13/10/2010	30	86.4	0.556	1.69	0.88	498.4	38.7	45.5	61.78	57.21	21.61	2.58	3.37	1.34		-17.75	-136.4	51.32
14/10/2010	31	89.5	0.568	1.72	0.91	461.9	39.2	45.3	63.77	58.19	47.92	3.18	3.23	1.36		-17.72	-136.4	55.04
15/10/2010	32	86.3	0.542	1.70	0.88	491.3	39.3	45.4	62.68	56.17	20.30	3.01	3.67	1.36		-17.69	-136.0	56.50
17/10/2010	34	85.7	0.551	1.69	0.88	493.6	38.6	45.6	65.51	57.67	22.14	2.56	2.85	1.31	0.711508	-17.76	-136.5	51.67
18/10/2010	35	86.3	0.554	1.71	0.89	497.6	39.0	45.6	64.80	56.82	22.01	1.58	3.08	1.33		-17.69	-135.7	53.73
21/10/2010	38	85.9	0.552	1.68	0.89	493.5	38.9	44.6	63.04	56.02	27.41	1.66	3.22	1.27		-17.70	-136.4	52.59
22/10/2010	39	86.6	0.555	1.70	0.90	496.5	39.2	44.8	63.01	55.73	25.36	1.53	4.61	1.29		-17.70	-136.1	55.87
23/10/2010	40														0.711528			55.13
25/10/2010	42	89.1	0.571	1.76	0.93	513.6	40.5	46.8	64.74	57.53	36.15	2.18	0.82	1.31		-17.83	-136.6	52.82
26/10/2010	43	89.5	0.574	1.77	0.93	512.2	40.6	46.4	64.07	57.63	16.82	1.91	0.49	1.31		-17.93	-136.9	56.08
27/10/2010	44	88.2	0.565	1.74	0.92	504.1	40.1	43.5	61.53	53.26	28.65	1.82	1.25	1.27		-18.00	-136.9	57.01
30/10/2010	47	90.6	0.581	1.81	0.95	518.7	41.4	47.0	66.76	58.39	21.50	1.23	3.88	1.34	0.711563	-17.94	-136.6	55.48
31/10/2010	48	91.0	0.593	2.23	1.01	539.2	44.6	46.2	66.77	54.75	35.07	2.03	2.63	2.16		-17.91	-136.2	58.89
02/11/2010	50	92.6	0.617	1.90	0.97	530.7	43.5	47.9	68.03	59.37	48.67	6.95	4.20	1.53		-17.98	-136.6	56.19
04/11/2010	52	90.7	0.584	1.86	0.96	521.5	42.1	48.2	69.09	59.72	29.40	1.55	1.48	1.48		-17.99	-136.7	55.92
06/11/2010	54	90.9	0.584	1.87	0.97	521.2	42.2	46.4	72.82	56.88	21.58	1.70	1.99	1.46		-17.85	-136.4	58.61
08/11/2010	56	91.0	0.584	1.86	0.97	518.9	42.3	46.5	65.09	57.43	25.09	1.68	4.74	1.43		-17.92	-136.7	55.28
10/11/2010	58	92.8	0.617	1.89	0.98	526.3	43.7	46.9	67.29	57.28	0.00	4.76	4.48	1.48		-17.87	-136.7	57.06
11/11/2010	59														0.711585			56.75
12/11/2010	60	93.6	0.622	1.89	0.99	530.3	44.1	47.6	68.54	58.19	29.90	5.20	0.52	1.46		-17.89	-136.7	55.85
14/11/2010	62	94.0	0.622	1.89	0.99	531.0	44.1	45.1	64.11	55.10	27.49	5.35	3.68	1.39		-17.68	-136.5	58.75
15/11/2010	63	91.8	0.592	1.85	0.97	507.7	42.3	47.2	67.42	57.09	31.92	2.29	3.91	1.31		-17.61	-136.4	58.40
17/11/2010	65	92.7	0.595	1.85	0.98	512.0	42.6	47.1	67.65	57.48	32.59	2.61	4.31	1.30	0.711621	-17.61	-136.4	59.56
19/11/2010	67	93.4	0.603	1.88	0.99	516.8	43.3	46.1	64.51	54.76	30.91	3.23	0.18	1.31		-17.64	-136.5	59.15
21/11/2010	69	93.8	0.603	1.89	1.00	518.4	43.6	46.1	66.86	55.30	26.29	2.94	6.03	1.33		-17.72	-136.4	59.80
23/11/2010	71	93.3	0.600	1.89	1.00	516.1	43.6	46.3	67.20	54.53	50.82	1.77	1.59	1.31		-17.63	-136.3	60.99
24/11/2010	72														0.711676			58.25
25/11/2010	73	94.5	0.610	1.97	1.03	524.1	44.9	47.3	67.58	55.57	34.25	2.04	5.86	1.33		-17.33	-135.3	62.23
27/11/2010	75	94.4	0.610	2.01	1.05	524.7	45.3	47.1	66.70	54.79	37.57	2.51	2.33	1.32		-17.37	-136.0	62.06
29/11/2010	77	94.6	0.613	2.08	1.07	528.4	46.2	47.5	68.10	53.99	42.93	3.15	0.13	1.42		-17.13	-134.8	65.17
30/11/2010	78	96.1	0.601	2.12	1.08	539.0	47.1	46.8	67.12	53.74	34.74	2.50	5.27	1.45		-17.46	-136.4	64.16

Table S2: Continued

Well 28WC2NW05 (continued)

Date	Day*	Na	K	Ca	Mg	Si	Sr	Cl	Br	F	SO ₄	Al	Fe	Mn	⁸⁷ Sr/ ⁸⁶ Sr	δ ¹⁸ O	δD	Alkalinity
		----- mmolar -----				--- μmolar ---		mmolar		----- μmolar -----						% (VSMOW)		meq
03/02/2011	143	106.9	0.792	5.61	1.90	706.7	82.4	47.1	70.03	32.59	108.75	5.39	11.64	5.06		-17.76	-136.3	77.97
04/02/2011	144	103.3	0.757	5.069	1.768	684.6	77.1	46.2	69.72	33.11	91.00	5.31	3.01	4.74		-17.84	-136.0	77.23
05/02/2011	145	104.5	0.759	5.095	1.767	692.0	77.1					5.13	0.27	4.75	0.711619	-17.24	-135.3	76.44
06/02/2011	146	104.0	0.759	5.085	1.759	692.8	76.9	46.4	69.25	36.26	97.07	5.55	11.54	4.81		-18.21	-135.9	77.96
07/02/2011	147	103.9	0.751	5.079	1.757	690.1	76.1	45.5	66.52	32.65	95.36	5.97	13.12	4.90		-18.25	-136.2	77.87
08/02/2011	148	103.9	0.751	5.033	1.748	688.3	75.6	45.9	66.59	33.99	93.46	6.58	16.41	4.95		-18.29	-135.9	78.16
09/02/2011	149	103.1	0.747	4.988	1.740	686.7	75.2	46.5	71.94	34.90	85.06	6.91	10.01	4.95		-18.39	-136.3	78.28
10/02/2011	150	103.7	0.750	5.005	1.753	687.3	75.5	46.5	70.17	34.60	93.48	7.00	8.11	5.07		-18.22	-136.6	78.25
11/02/2011	151	104.9	0.761	5.065	1.780	696.0	76.5	46.0	67.80	34.09	182.51	6.37	16.57	5.13		-18.20	-136.2	81.89
12/02/2011	152	105.2	0.762	5.080	1.789	699.1	77.1	46.8	70.19	36.16	91.79	6.81	0.62	5.18		-18.30	-136.2	76.81
13/02/2011	153	105.0	0.758	5.070	1.785	695.5	77.0	45.8	67.91	33.57	89.30	5.97	12.88	5.21	0.711669	-18.34	-135.5	80.64

Well 30WC2NW05

13/09/2010	1	72.5	0.683	2.648	1.173	651.9	42.4	39.6	59.70	60.93	47.15	1.64	0.97	1.84	0.713555	-18.28	-140.3	41.11
16/09/2010	3	72.7	0.688	2.813	1.211	660.9	43.9	39.6	59.55	58.82	65.78	2.20	0.61	1.80		-18.30	-140.3	41.58
17/09/2010	4	72.2	0.678	2.864	1.218	681.1	45.4	39.5	59.78	58.87	62.50	2.55	0.91	1.75		-18.32	-140.5	41.31
19/09/2010	7	73.0	0.696	2.963	1.244	670.9	45.3	39.6	58.83	56.81	69.40	2.13	0.57	2.06		-18.32	-140.5	42.43
20/09/2010	7	70.8	0.663	2.953	1.215	665.7	45.3	39.7	60.30	57.02	101.97	1.04	0.71	2.13		-18.30	-140.4	39.87
22/09/2010	9	73.6	0.702	3.067	1.265	679.0	46.1	39.7	60.21	57.57	78.79	2.97	3.02	2.26	0.713515	-18.16	-139.2	43.14
23/09/2010	10	72.0	0.660	3.035	1.228	659.6	46.8	40.3	59.39	59.79	78.23	2.75	14.20	2.16		-18.15	-139.5	40.74
26/09/2010	13	75.5	0.714	3.051	1.295	685.7	47.2	40.0	60.42	58.25	85.51	3.84	0.95	1.88		-18.28	-139.8	44.72
27/09/2010	14	71.6	0.667	2.921	1.226	666.9	45.7	39.8	59.97	57.10	110.72	1.86	0.60	1.77				46.29
28/09/2010	15	73.5	0.695	2.962	1.257	672.7	45.8	39.9	59.81	63.62	69.68	3.13	6.82	1.78		-18.23	-139.6	
01/10/2010	18	70.9	0.662	2.940	1.223	664.1	45.6	39.8	61.06	57.58	74.33	2.26	6.74	1.74		-18.13	-139.2	45.54
02/10/2010	19	73.0	0.690	2.963	1.252	664.6	45.5					2.31	4.71	1.71	0.713417			45.94
02/10/2010	19	73.4	0.696	2.986	1.259	668.8	45.8					3.24	13.60	1.74				44.91
02/10/2010	20	73.2	0.692	2.978	1.256	667.8	45.6					3.92	13.85	1.72				45.87
04/10/2010	21	68.5	0.642	2.873	1.187	648.3	44.3	39.9	58.56	58.33	92.57	1.93	13.31	1.74		-18.24	-139.9	48.51
05/10/2010	22	72.4	0.687	2.980	1.248	663.6	45.3	39.7	59.61	57.37	73.43	4.19	14.20	1.82		-18.25	-140.1	50.09
07/10/2010	24	70.4	0.662	3.006	1.230	667.8	45.5	39.6	60.62	57.71	66.07	4.61	13.96	1.97		-18.30	-140.3	43.64
08/10/2010	25	71.1	0.697	3.041	1.248	657.9	45.2	39.9	60.06	57.63	88.54	3.73	13.05	2.00		-18.27	-140.5	44.36
10/10/2010	27	72.7	0.657	2.899	1.202	649.6	44.9	39.5	60.45	56.66	87.20	2.27	11.76	1.86	0.713281	-18.26	-140.5	54.28
11/10/2010	28	72.5	0.695	3.239	1.306	680.8	47.0	39.6	59.43	54.88	93.16	3.21	12.59	1.96				50.75
12/10/2010	29	76.8	0.654	2.911	1.143	664.9	44.5	40.5	60.71	53.06	85.87	2.82	10.49	1.87		-18.18	-139.6	55.85
14/10/2010	31	79.5	0.673	3.053	1.196	706.9	45.6	40.4	60.74	50.24	96.62	3.04	11.58	1.99		-18.21	-139.8	51.32
15/10/2010	32	76.5	0.658	3.059	1.174	676.2	45.4	40.6	62.18	51.62	82.65	3.32	12.66	2.01		-18.17	-139.7	55.55

Table S2: Continued

Well 30WC2NW05 (continued)

Date	Day*	Na	K	Ca	Mg	Si	Sr	Cl	Br	F	SO ₄	Al	Fe	Mn	⁸⁷ Sr/ ⁸⁶ Sr	δ ¹⁸ O	δD	Alkalinity
		mmolar				μmolar			mmolar			μmolar				‰ (VSMOW)		meq
17/10/2010	34	76.8	0.663	3.105	1.181	676.3	45.6	40.6	60.68	50.41	99.70	3.06	11.67	2.03		-18.34	-139.6	54.71
18/10/2010	35	77.4	0.662	3.155	1.191	680.4	46.0	40.5	61.97	50.33	124.21	3.15	11.26	2.07	0.713172	-18.32	-139.7	51.37
20/10/2010	37	77.9	0.703	3.229	1.214	700.0	47.8	40.2	59.16	49.72	97.53	7.48	11.28	2.14		-18.59	-140.0	53.23
22/10/2010	39	77.2	0.661	3.197	1.198	683.6	46.2	40.2	61.29	49.21	81.25	2.71	12.46	2.10		-18.67	-140.1	53.86
23/10/2010	40	76.5	0.654	3.178	1.189	678.0	46.0	40.3	63.20	49.67	102.40	2.42	11.11	2.09		-18.74	-140.1	49.64
25/10/2010	42	79.5	0.681	3.370	1.258	704.5	48.4	40.2	61.19	49.02	116.05	2.48	0.94	2.28	0.713183	-18.74	-139.6	54.67
28/10/2010	45	80.5	0.684	3.457	1.279	707.8	49.5	40.5	66.72	46.15	105.53	2.53	7.74	2.42		-18.71	-139.7	51.23
30/10/2010	47	81.9	0.697	3.637	1.338	727.8	51.6	40.3	60.30	44.92	113.80	3.21	12.80	2.64		-18.34	-139.9	55.68
31/10/2010	48	81.7	0.698	3.658	1.346	730.5	51.9	40.5	60.73	46.60	154.11	3.18	14.93	2.67		-18.36	-140.2	58.82
02/11/2010	50	81.5	0.704	4.088	1.389	734.8	54.5	40.2	59.61	43.40	127.86	2.88	19.70	3.57	0.713087	-18.71	-140.2	57.87
04/11/2010	52	78.6	0.714	4.161	1.442	742.3	54.7	39.4	58.14	46.39	127.88	4.37	29.27	3.72		-18.83	-140.7	53.31
05/11/2010	53	78.1	0.717	4.148	1.461	746.9	54.8	39.3	62.01	47.07	127.77	4.13	28.87	3.54		-18.94	-140.6	55.38
08/11/2010	56	77.0	0.721	4.136	1.485	746.9	55.3	39.0	58.93	47.38	125.54	2.63	25.92	3.24		-18.95	-140.9	53.13
10/11/2010	58	77.9	0.769	4.450	1.557	772.6	58.5	38.9	59.19	45.85	128.52	7.16	25.44	3.36	0.713554	-18.94	-140.8	53.90
12/11/2010	60	78.5	0.775	4.482	1.564	775.6	58.9	39.2	60.24	47.28	158.73	7.21	25.33	3.38		-18.68	-138.9	55.90
14/11/2010	62	77.7	0.774	4.430	1.548	768.7	58.0	38.9	59.83	47.55	135.74	7.04	25.68	3.20		-19.09	-140.5	52.34
15/11/2010	63	76.5	0.727	4.388	1.534	736.8	55.9	38.7	60.89	47.06	145.47	4.40	24.73	3.03		-19.03	-141.3	55.44
17/11/2010	65	75.9	0.727	4.421	1.538	738.7	55.7	38.5	60.02	47.79	135.96	4.89	24.28	3.02		-18.81	-141.0	51.49
19/11/2010	67	79.7	0.764	4.663	1.607	770.8	58.4	38.5	58.65	46.95	160.55	3.73	0.11	3.20	0.713663	-18.79	-140.5	53.40
21/11/2010	69	76.4	0.722	4.451	1.510	735.3	55.3	38.9	59.39	48.95	148.79	3.90	22.53	3.21		-18.85	-141.6	61.43
23/11/2010	71	76.7	0.728	4.544	1.526	740.6	55.9	38.4	58.83	48.06	139.75	3.41	1.05	3.29				58.76
25/11/2010	73	75.5	0.717	4.464	1.492	729.4	54.5	38.2	59.06	48.58	124.60	4.79	22.53	3.26	0.713652			56.72
27/11/2010	75	77.0	0.730	4.499	1.511	741.5	55.0	38.2	59.14	49.47	139.70	4.20	15.17	3.35				52.83
29/11/2010	77	77.5	0.728	4.451	1.507	745.4	54.9	38.6	58.10	48.35	151.95	4.66	21.69	3.44				53.19
30/11/2010	78	77.9	0.719	4.448	1.494	749.8	55.2	38.7	60.25	49.72	152.04	4.84	21.44	3.63	0.713603			59.86
03/02/2011	143	79.4	0.822	6.174	1.873	814.2	67.7	36.4	57.99	40.57	138.60	7.99	26.33	6.94				
04/02/2011	144	80.9	0.822	6.055	1.815	806.0	66.6	37.2	59.11	40.84	151.47	8.04	9.23	6.78	0.713574			61.32
05/02/2011	145	81.0	0.823	6.029	1.817	806.1	66.5					6.53	16.15	6.72				62.51
06/02/2011	146	80.9	0.824	6.018	1.824	805.3	66.6	37.4	58.04	37.25	176.35	6.42	12.63	6.60				65.15
07/02/2011	147	80.0	0.824	6.025	1.834	808.5	66.4	37.0	59.12	40.55	151.14	7.18	2.55	6.40				63.02
08/02/2011	148	79.7	0.826	6.021	1.839	808.9	66.3	37.8	58.88	41.93	182.99	7.42	18.31	6.24	0.713749			63.72
09/02/2011	149	79.7	0.825	6.006	1.829	805.1	66.1	37.0	57.76	41.51	152.21	6.96	11.07	6.41				61.78
10/02/2011	150	80.3	0.828	6.032	1.851	811.6	66.7	37.1	59.28	40.49	151.94	8.04	9.93	6.33				63.60
11/02/2011	151	79.4	0.820	6.018	1.860	817.4	67.6	36.9	58.88	39.45	157.14	8.20	10.07	6.21				60.84
12/02/2011	152	79.5	0.832	6.069	1.878	817.8	67.1	36.9	57.81	39.75	169.89	8.16	25.91	6.16				62.31
13/02/2011	153	79.2	0.839	6.205	1.918	826.2	68.3	36.8	57.67	41.87	147.51	7.33	24.19	6.33	0.713817			

Table S2: Continued

Injection brines

Date	Day*	Na	K	Ca	Mg	Si	Sr	Cl	Br	F	SO ₄	Al	Fe	Mn	⁸⁷ Sr/ ⁸⁶ Sr	δ ¹⁸ O	δD	Alkalinity	
		----- mmolar -----				--- μmolar ---		mmolar		----- μmolar -----						%o (VSMOW)			meq
13/09/2010	1	102.6	0.672	4.76	1.72	625.8	75.6	42.9	58.66	35.75	241.96	1.99	1.38	10.09	0.710925	-17.47	-135.7	78.52	
13/09/2010	1	102.6	0.672	4.76	1.72	625.8	75.6	46.6	69.91	32.80	686.22	1.99	1.38	10.09	0.710916	-17.36	-135.5	76.87	
19/10/2010	37	104.1	0.701	4.50	1.65	607.9	72.1					4.69	10.63	9.15	0.710929	-17.68	-137.2		
26/10/2010	44	106.6	0.734	4.84	1.79	639.9	77.3	45.9	63.86	31.67	392.53	4.94	1.50	10.28	0.710991	-17.58	-136.5		
00/01/1900	47														0.710873				
02/11/2010	50	104.2	0.687	4.76	1.78	654.1	78.0	45.8	43.36	36.48	79.27	2.81	16.17	9.97	0.710945			76.65	
05/11/2010	53	104.2	0.697	4.81	1.83	654.8	78.8	45.3	63.30	33.02	451.32	3.11	6.15	10.02	0.000000	-17.83	-135.8	80.54	
09/11/2010	57	108.4	0.727	4.40	1.67	618.7	74.8	49.0	66.40	37.88		4.99	0.53	9.30	0.710823	-17.84	-137.1	77.27	
00/01/1900	60														0.710869				
21/11/2010	69	104.1	0.688	4.68	1.80	625.4	76.6	47.4	64.60	32.20	711.94	4.13	18.06	9.88	0.710897	-17.97	-136.9	81.50	
28/11/2010	76	105.2	0.705	5.05	1.87	625.6	80.1					3.68	0.35	11.68	0.710882	-18.04	-138.0	83.55	
09/02/2011	150	111.5	0.747	5.13	1.92	635.1	82.7	46.4	61.24	32.31		5.47	11.82	12.35	0.710757	-18.70	-140.1		
13/02/2011	154	111.0	0.749	5.25	1.92	648.2	84.0	45.3	62.58	33.52	846.67	4.48	3.23	12.78	0.710780	-17.97	-136.9		

* Day is number of days since CO₂ injection commenced in hole 37WC2NW05

Table S3: Continued

Sample	Na	K	Ca	Mg	Al	Fe	Mn	Sr	Si*	S	⁸⁷ Sr/ ⁸⁶ Sr	1σ
				mmole/Kg				μmolar/kg	mmole/Kg			(ppm)
Core 26WC2NW05												
B11/2/2438 H ₂ O	12.22	1.56	1.84	0.61	4.95	0.62	0.02	8.26		3.15		
B11/2/2438 Hac	5.63	1.50	47.95	0.00	2.63	41.58	44.44	2588.47	1.29	0.55	0.707632	7
B11/2/2438 HCl	1.17	1.40	10.04	4.48	14.97	14.46	0.14	43.80	0.52	0.24	0.709562	8
B11/2/2438 Res	521.51	317.84	97.92	15.87	825.33	56.01	0.19	2281.82	13.01	3.70	0.707151	7
B11/2/2438 WR	234.60	153.51	734.82	19.91	225.83	47.34	110.11	3921.95	13.30	17.99	0.707442	6
% Sum - WR**	130.4	110.0	-78.5	5.3	275.4	138.0	-59.3	25.5	11.4	-57.5		
Core 26WC2NW05												
B11/4/2466 H ₂ O	35.25	4.51	2.83	7.34	62.55	2.60	0.01	44.49		5.66		
B11/4/2466 Hac	19.46	1.38	22.46	2.69	2.38	3.79	0.15	159.83	0.24	0.46	0.708263	8
B11/4/2466 HCl	1.84	2.51	8.96	8.28	25.20	22.11	0.10	43.80	0.70	0.53	0.709022	9
B11/4/2466 Res	643.56	247.07	146.53	37.68	979.07	101.47	0.44	2649.94	14.11	5.73	0.708027	7
B11/4/2466 WR	683.12	291.30	190.75	71.93	1261.31	134.61	0.71	3237.77	13.91	17.37	0.708124	7
% Sum - WR	2.5	-12.3	-5.2	-22.2	-15.2	-3.4	-1.9	-10.5	8.3	-28.7		
Clasts and Minerals Picked from sample A2334, core 6WC2NW05												
Lithic H ₂ O	2.4	0.27	1.40	0.04	0.16	0.02	0.00	5.37	0.53	0.13		
Lithic HAC	8.6	2.76	336.28	9.10	28.44	27.95	2.81	1028.67	3.60	1.17	0.707724	7
Lithic HCl	2.8	2.44	68.80	19.42	63.30	68.68	0.10	126.28	2.32	0.49	0.707775	8
Lithic Residue	1030.7	516.36	84.85	30.34	2236.69	74.69	0.17	4760.87		5.57	0.706085	8
Volc H ₂ O	6.48	0.56	0.29	0.47	4.45	0.28	0.00	2.59	6.51	0.83		
Volc HAC	33.16	3.17	163.07	24.26	31.05	50.97	1.17	669.67	2.94	3.01	0.707865	8
Volc HCl	0.28	0.84	3.65	7.13	23.75	27.69	0.04	14.46	0.43	0.25	0.709737	10
Volc Residue	302.95	283.22	71.17	139.19	1700.06	345.02	1.21	2051.17	0.32	171.73	0.708801	7
Plag I H ₂ O***	20.66	1.10	42.37	0.52	2.85	0.18	0.14	132.77	5.58	3.09		
Plag II H ₂ O***	22.12	0.85	10.57	0.16	0.24	0.07	0.06	29.01	0.83	2.53		
Plag I Hac***	21.19	3.88	2582.30	23.36	44.18	59.84	20.05	7466.92	12.42	15.70	0.707728	7
Plag II Hac***	9.18	2.75	4723.69	30.10	25.22	118.89	38.30	13780.47				
Plag HCl	90.00	3.44	5.69	13.72	63.38	48.45	0.06	206.28	4.47	100.53	0.708101	10
Plag Residue	1259.32	791.04	184.05	25.99	3232.93	74.50	0.21	9149.63			0.710621	7

Table S3: Continued

Sample	Na	K	Ca	Mg	Al	Fe	Mn	Sr	Si*	S	⁸⁷ Sr/ ⁸⁶ Sr	1σ
Frontier Fm.****	mmole/Kg							μmolar/kg	mmole/Kg			(ppm)
FR 1	338.50	474.78	109.94	91.12	745.64	138.46	0.56	1803.11	14480.37	0.78	0.711220	7
FR 2	395.87	360.58	158.21	76.19	741.26	126.91	0.93	2436.28	14524.22	3.05	0.709442	7
FR 3	264.09	303.11	2729.57	43.46	452.30	156.57	9.75	3785.85	12691.10	7.44	0.707610	8
FR 4	716.16	104.62	43.88	367.22	1284.87	363.58	0.65	542.60	13225.00	9.81	0.709132	6
FR 8	260.12	301.56	2629.67	69.72	478.93	119.14	59.70	4635.33	12700.17	8.89	0.708568	9
FR 9	734.23	668.11	297.54	33.19	933.50	136.04	0.28	2831.74	13671.31	2.26	0.709151	7
FR 12	1441.75	700.23	149.32	5.35	852.82	96.02	0.40	9706.21	13629.73	1.14	0.714862	7
FR 13	324.45	407.22	52.02	109.89	703.88	128.28	0.66	1084.33	14656.95	7.21	0.714929	7
FR 14	222.91	526.04	144.40	103.92	765.62	141.64	0.51	1165.92	14412.23	6.85	0.717370	7
FR 15	182.73	276.10	2939.52	80.62	463.64	183.26	7.54	3727.85	12490.63	1.37	0.708287	6
FR 15 Leach	1.68	2.04	2293.39	31.67	7.74	64.51	5.96	2503.10		nd	0.707541	8
FR 16	183.84	213.24	29.67	65.29	547.24	226.18	0.19	543.20	15077.37	1.16	0.712784	7
FR 17a	237.65	306.69	94.22	94.95	667.25	229.32	0.74	749.08	14682.50	4.73	0.712474	7
FR 17b	263.19	365.83	45.23	76.74	721.76	176.68	0.46	630.17	14664.53	0.77	0.713695	7
FR 18	179.43	247.21	2660.34	104.52	420.52	200.02	9.33	4230.64	12805.04	3.26	0.708119	7
FR 18 Leach	2.52	1.76	2018.06	34.35	5.79	53.39	7.31	2850.84		nd	0.707553	10
FR 19	171.92	202.01	50.28	89.12	488.53	312.84	0.26	529.59	15042.06	0.72	0.712064	9
FR 20	238.32	528.96	74.26	207.85	992.76	576.08	1.02	605.68	13441.85	1.65	0.719212	7
FR 21	445.90	485.70	114.42	146.36	828.25	306.30	0.75	838.93	14009.37	2.40	0.714016	6
FR 22	279.76	325.60	32.88	67.88	709.56	166.56	0.31	648.61	14739.31	0.79	0.713406	7
FR 23	483.95	322.89	1545.33	99.26	633.96	155.86	14.45	3950.82	13323.33	2.34	0.708672	7
FR 24	362.22	376.59	339.54	138.46	762.05	180.07	7.93	1309.41	14162.74	30.16	0.712698	8
FR 25	164.51	236.36	582.47	31.09	472.46	58.81	1.60	1929.23	14922.33	1.95	0.708848	7

Table S3: Continued

* Si calculated by difference between sum of cations and total for whole rock and residue analyses which used HF digestions.

** Large discrepancies between sums of cations from leach and residue and whole rock analysis appears to be due to low whole rock analyses for several elements.

*** Two separate fractions of picked plagioclase were leached in water and acetic acid and the residues combined for the HCl leach and analysis of the residue from the HCl leach.

**** Whole rock analyses except two samples HAc leaches

§ Leaching procedures

Stage	Sample	Ultrasonic	Reaction period	Centrifuge	Rinse
Water leach	Add 200 mg fine ground bedload to pre-cleaned centrifuge tube	shake, ultrasonic 10 minutes, shake	2 hours	shake, ultrasonic for 10 minutes, then 20 minutes in centrifuge	Pipette off water and discard
Acetic acid leach (HAc)	Add 5 ml 10% acetic acid to residue from water leach	shake, ultrasonic 10 minutes, shake	>8 hours (overnight)	shake, then 20 minutes in centrifuge	Pipette off acetic acid into 2 aliquots
HCl leach	Add 5 ml 1 molar HCl to residue from acetic acid leach	shake, ultrasonic 10 minutes, shake	>8 hours (overnight)	shake, then 20 minutes in centrifuge	Pipette off HCl into 2 aliquots
Residue	Residue from HCl leach heated at 900 - 950 °C for 8 hours to ignite organics and then taken into solution using HF + HNO ₃ , HNO ₃ and HCL dissolutions in teflon-lined bombs at 180 °C. Aliquots were taken for AES cation and ⁸⁷ Sr/ ⁸⁶ Sr analyses.				

Repeat 3 times: add 5 ml water, shake, ultrasonic for 10 minutes, shake, centrifuge for 20 mins, pipette off water and discard.
Repeat 3 times: add 5 ml water, shake, ultrasonic for 10 minutes, shake, centrifuge for 20 mins, pipette off water and discard.

Table S4: Compositions of Wall Creek, Tensleep and Madison Fluids from Teapot Dome

Well	Date	Formation	Na	K	Ca	Mg	Si	Sr	Cl	Br	F	SO ₄	⁸⁷ Sr/ ⁸⁶ Sr	1σ ppm	Alkalinity
			----- mmolar -----				— μmolar ---		mmolar	— μmolar ---		mmolar	meq		
85AX20	05/05/2009	2nd Wall Creek	89.76	0.344	0.332	0.171	444.5	16.37	46.48	120.3	118.2	0.138	0.708164	7	44.74
84AX20	05/05/2009	2nd Wall Creek	64.46	0.266	0.240	0.157	408.3	9.49	34.13	67.7	159.3	0.368	0.708319	8	35.15
72TPX10	05/05/2009	Tensleep	26.47	1.937	6.767	1.409	865.3	84.17	23.69	26.3	247.4	9.90	0.718324	7	2.13
75TPX10	05/05/2009	Tensleep	28.47	2.183	6.999	1.402	911.5	86.70	26.26	28.1	249.6	9.72	0.717838	8	2.40
76TPX10	07/05/2009	Tensleep	31.80	2.254	6.967	1.353	950.2	70.85	29.50	28.3	250.8	9.78	0.719300	9	2.57
17WX21	05/05/2009	Madison	22.68	1.366	7.573	1.602	762.8	61.06	18.30	16.4	234.3	11.15	0.719303	11	1.94
57WX3	06/05/2009	Madison	29.72	1.934	6.838	1.392	951.7	68.11	26.54	26.2	249.5	9.77	0.720630	7	2.24