GSA Data Repository Item 2018298

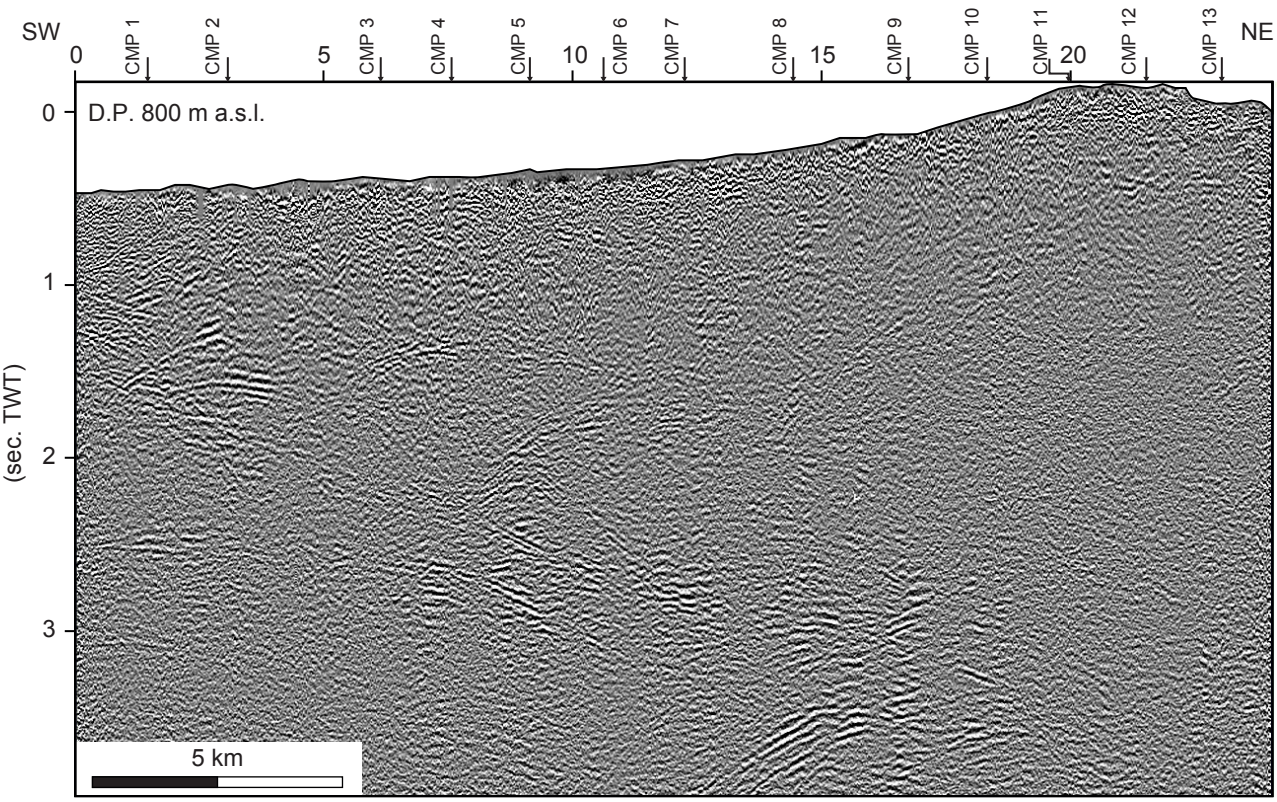
Lucca, A., Storti, F., Molli, G., Muchez, P., Schito, A., Artoni, A., Balsamo, F., Corrado, S., and Salvioli Mariani, E., 2018, Seismically enhanced hydrothermal plume advection through the process zone of the Compione extensional Fault, Northern Apennines, Italy: GSA Bulletin, https://doi.org/10.1130/B32029.1.

Data Repository

Figure DR1. Seismic reflection profile of Fig. 2 before being depth-converted.

Figure DR2. (A-B) Outcrop pictures of coarse sandstones strata in footwall damage zone Site 5. White dotted lines represent bedding, white lines are conjugate extensional shear veins and fractures with σ_1 orthogonal to bedding, black dashed lines are late-stage extensional shear fractures and red dashed lines indicate strike-slip shear veins and fractures. White arrows indicate pre-bedding rotation kinematics while black arrows indicate kinematics after bedding rotation. (C) Stained hand specimen of footwall fault-related shear vein; black dotted lines separate different opening events. (D) XPL image showing, as in C, multiple openings (separated by white dotted lines), of which some interested by shearing and quartz recrystallization. (E) PPL image of vein showing both MC1A and MC2 replacive calcite crystals along with quartz and rhombohedric MC1A. (F-G-H) CL images showing progressive prehnite dissolution and replacement by MC calcites.

Figure DR3. Fluid inclusion assemblage in quartz of footwall damage zone fault-related shear veins showing aqueous inclusion (white), gaseous CH4 inclusions (black) and an inclusion containing liquid H2O and gaseous CH4 (black and white). In (A) at 20 °C and in (B) at -100 °C.



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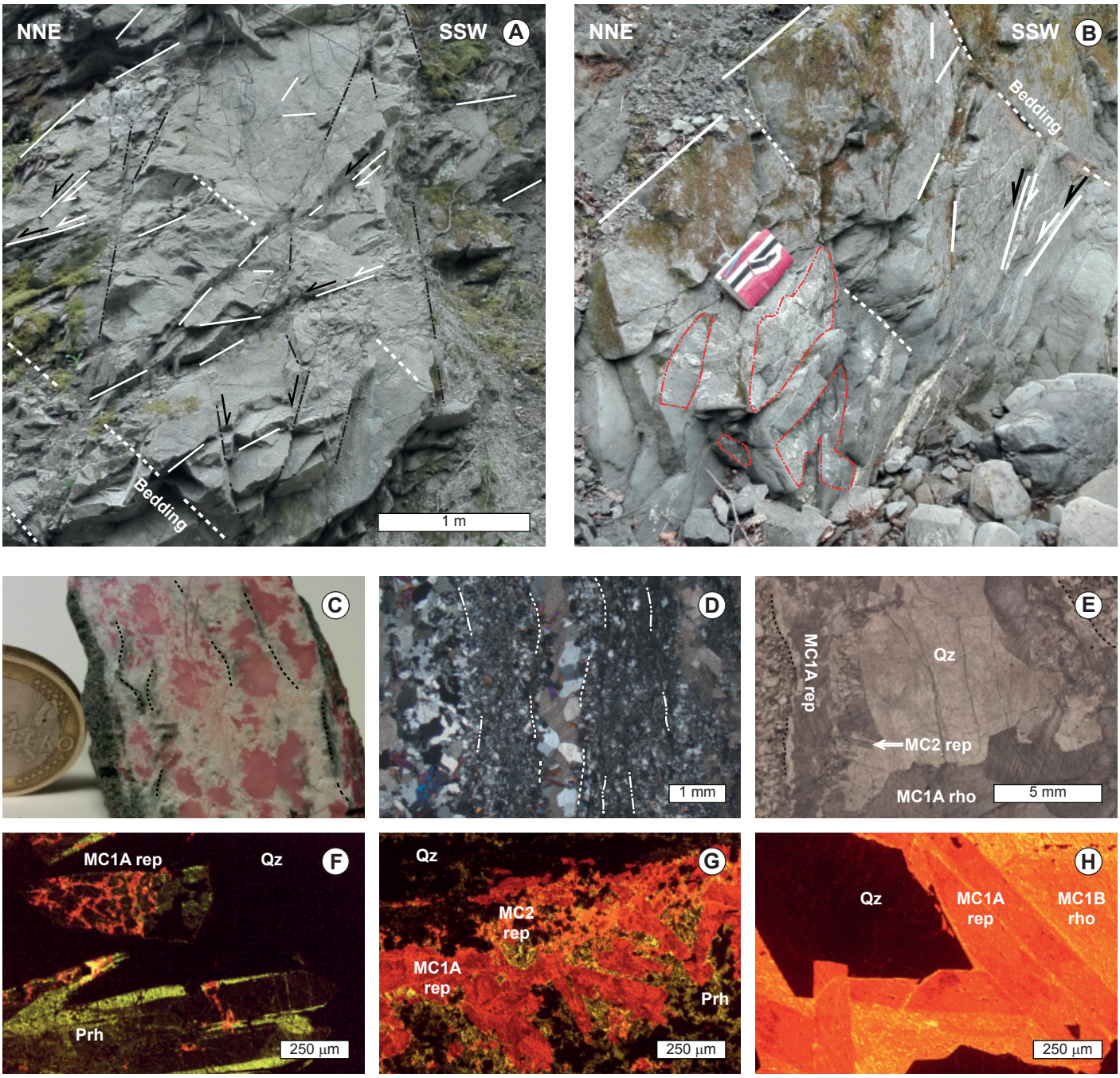

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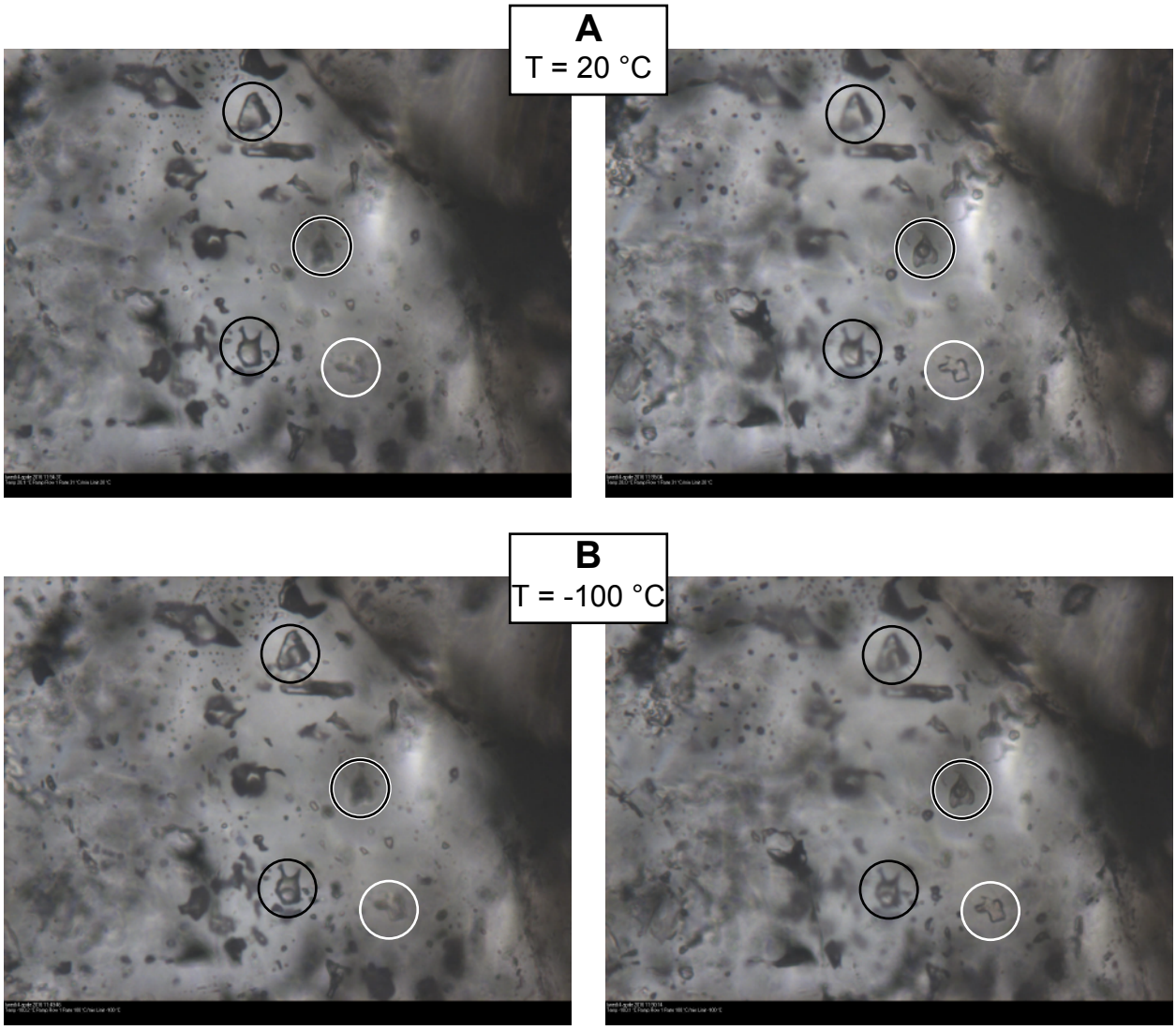

Figure S3. Fluid inclusion assemblage in quartz of footwall damage zone fault-related shear veins showing aqueous inclusion (white), gaseous CH_4 inclusions (black) and an inclusion containing liquid H_2O and gaseous CH_4 (black and white). In (A) at 20 °C and in (B) at -100 °C.

Structural sites and samples list

Coordinates	Site N.	Sample N.	Description	Domain	Strike	Dip	Pitch
			Vein & Fault Samples				
44°19'27.39"N 10° 3'14.29"E	1	1	Longitudinal antithetic vein-stylolites	HW_DZ	355	32	
	1	2	Longitudinal synthetic vein-stylolites	HW_DZ	307	65	
44°19'27.77"N 10° 3'19.43"E	2	1	Longitudinal synthetic vein-stylolites	HW_DZ	320	80	
	2	2	Fault core calcite concretion	HW_DZ			
	2	3	Obliquely sheared vein	HW_DZ	290	50	
	2	4	Bed parallel vein-stylolites	HW_DZ	76	16	
	2	5	Longitudinal synthetic shear vein	HW_DZ	60	23	120
44°19'30.72"N 10° 3'21.57"E	3	1A	Fault core Breccia	HW_FC			
	3	1B	Fault core Breccia	HW_FC			
	3	1C	Fault core Breccia	HW_FC			
	3	2	Bed parallel vein-stylolites	HW_DZ-FC transition	118	60	
	3	3	Transversal vein-stylolites	HW_DZ-FC transition	196	67	
	3	4	Fault core calcite concretion	HW_DZ-FC transition	126	65	
	3	5	Transversal vein-stylolites	HW_DZ-FC transition	196	67	
	3	6	Longitudinal antithetic shear vein	HW_DZ-FC transition	309	64	100
44°19'40.65"N 10° 3'30.93"E	4	1	Transversal shear vein	FW_DZ	230	85	
	4	2	Transversal vein	FW_DZ	0	75	
	4	3	Longitudinal shear vein	FW_DZ	305	47	
	4	4	Transversal slip surface	FW_DZ	236	83	25
	4	5	Transversal shear vein	FW_DZ	0	61	
	4	6	Vein in clay bed	FW_DZ	276	45	
44°19'37.98"N 10° 3'28.42"E	5	1	Antithetic slip surface	FW_DZ	299	51	130
	5	2	Transversal shear vein	FW_DZ	195	86	
	5	3	Transversal vein	FW_DZ	205	69	
	5	4	Antithetic slip surface	FW_DZ	200	36	
	5	5	Longitudinal synthetic vein	FW_DZ	334	70	
	5	6	Longitudinal synthetic vein	FW_DZ	334	70	
	5	7	Oblique shear vein	FW_DZ	351	55	
	5	8	Oblique shear vein	FW_DZ	40	46	
	5	9	Oblique shear vein	FW_DZ	66	54	
44°19'42.06"N 10° 3'4.34"E	6	1	Fault core synthetic slip surface	FW_DZ-FC transition	150	60	
	6	2	Vein in clay bed	FW_DZ-FC transition	330	45	
	6	3	Vein in silt bed	FW_DZ-FC transition	330	45	
	6	4	Synthetic shear vein	FW_DZ-FC transition	80	50	120
	6	5	Transversal shear vein	FW_DZ-FC transition	233	84	10
44°20'4.01"N 10° 2'20.67"E	7	1	Transversal vein	FW_DZ	230	80	
	7	2	Transversal shear vein	FW_DZ	230	80	
	7	3	Transversal vein	FW_DZ	230	80	
	7	4	Transversal shear vein	FW_DZ	230	80	
44°19'50.13"N 10° 2'38.41"E	8	1	Fault core calcite concretion	HW_DZ-FC transition	135	76	
	8	2	Longitudinal antithetic breccia-vein	HW_DZ-FC transition	336	86	
	8	3	Fault core S-C	HW_DZ-FC transition	156	23	
	8	4	Fault core S-C	HW_DZ-FC transition	156	23	
44°19'42.26"N 10° 2'38.35"E	9	1	Thrust R' vein	HW_DZ	323	40	
	9	2	Transversal vein	HW_DZ	238	76	
	9	3	Bed parallel vein-stylolites	HW_DZ	127	56	
44°19'38.33"N 10° 2'54.02"E	10	1	Thrust footwall vein-stylolites	HW_DZ	134	70	
	10	2	Thrust hangingwall vein-stylolites	HW_DZ	332	64	
44°19'0.16"N 10° 3'13.04"E	11	1	Longitudinal synthetic vein	HW_BG	280	50	
44°19'33.34"N 10° 4'43.09"E	12	1	Transversal vein	FW_BG	254	72	
44°24'51.31"N 9°57'4.64"E	13	1	Fault Core Breccia	FW_DZ NW tip			

Oxygen and carbon stable isotopes contents

Calcite Type	Site/ Sample		$\delta^{13}C$ (V-PDB)	$\delta^{18}O$ (V-PDB)	$\delta^{18}O$ (V-SMOW)
Macigno Host Rock					
	4/6		-3,1	-16,1	14,2
	4/6		-2,6	-16,4	13,9
	6/2		-0,7	-14,4	16,0
MC1 (A & B) Calcite					
	4/1		-1,0	-17,6	12,8
	4/2		-2,7	-18,5	11,8
	4/3		-1,2	-16,5	13,8
	4/3	Replacive	-1,6	-17,0	13,4
	4/5		-1,5	-17,4	12,9
	4/6		-1,3	-17,7	12,7
	5/2	Replacive	-4,4	-16,9	13,4
	5/2	Replacive	-4,3	-17,0	13,3
	5/3		-4,3	-17,3	13,0
	5/3	Replacive	-4,6	-17,1	13,3
	5/4		-5,7	-17,0	13,4
	5/4	Replacive	-5,7	-17,1	13,3
	5/6		-4,9	-17,1	13,2
	5/7		-4,8	-17,8	12,5
	5/7	Replacive	-4,4	-18,2	12,1
	5/8		-5,6	-18,0	12,3
	5/9		-5,0	-17,7	12,6
	6/2		-2,3	-17,2	13,2
	6/2	Replacive	-2,1	-16,5	13,9
	6/3		-0,9	-16,4	13,9
	7/1		-1,3	-16,4	14,0
	NWtip		-0,6	-14,9	15,5
	NWtip	Replacive	-0,8	-13,7	16,7
MC2 Calcite					
	4/1		-1,5	-14,4	16,0
	4/2		-2,1	-15,9	14,4
	4/2	Replacive	-1,8	-14,6	15,8
	4/3		-1,2	-14,8	15,7
	4/5		-1,5	-15,8	14,5
	4/6		-1,6	-13,4	17,0
	5/6		-4,8	-14,8	15,6
	5/7		-3,8	-14,5	15,9
	5/8		-6,1	-13,2	17,2
	5/8		-7,1	-15,7	14,6
	5/9		-4,3	-16,5	13,9
	5/9	Replacive	-5,3	-14,0	16,5
	6/1		-1,2	-12,6	17,9
	6/1		-0,4	-13,0	17,5
	6/2		-1,4	-14,9	15,5
	6/2		-1,2	-14,5	15,9
	6/3		-1,3	-16,9	13,4
	7/1		-1,5	-14,3	16,2
	NWtip		-0,5	-10,7	19,8
Ottone HR					
	10/2		1,8	-3,5	27,2
	9/2		1,9	-3,2	27,5
	1/2		1,7	-3,8	27,0
	3/5		2,0	-3,8	26,9
OC1 Calcite					
	10/1		1,9	-4,8	25,9
	10/1		2,1	-4,7	26,0
	10/2		2,0	-4,8	25,9
	9/2		1,9	-5,1	25,6
	9/2		1,8	-4,5	26,2
	9/3		1,8	-5,0	25,7
	9/3		1,6	-5,5	25,2
	1/1		2,2	-4,5	26,2
	1/1		2,3	-4,7	26,0
	1/2		2,4	-5,7	25,0
	1/2		1,9	-4,4	26,3
	1/2		2,1	-3,9	26,9
	2/1		2,0	-5,1	25,6
	2/1		1,8	-5,0	25,7
	2/3		1,8	-4,3	26,4
	2/4		1,7	-5,4	25,3
	2/4		1,9	-5,7	25,0
	2/4		1,8	-5,0	25,7
	2/5		1,9	-5,0	25,7
	2/5		1,7	-5,6	25,1
	2/5		2,0	-4,4	26,3
	3/3		1,8	-7,1	23,5
	3/3		2,0	-5,8	24,9
	3/4		2,0	-4,2	26,6
	3/5		2,1	-5,3	25,4
	3/6		2,0	-4,7	26,0
OC2 Calcite					
	10/1		1,3	-12,6	17,9
	10/2		1,4	-14,3	16,1

9/3	Replacive	-0,5	-15,3	15,0
8/1		2,1	-15,4	15,0
8/1		1,9	-14,4	16,0
1/1		2,1	-13,6	16,8
2/1		2,0	-14,0	16,5
2/3		2,0	-14,0	16,4
3/2		1,7	-17,3	13,1
3/2		2,1	-15,1	15,3
3/3		2,1	-13,4	17,1
3/3		2,1	-14,0	16,5
3/4		2,1	-13,8	16,6
3/5		2,1	-12,4	18,1
3/5		2,1	-11,9	18,6
3/6		2,0	-10,9	19,7

Fluid inclusions microthermometry

Inclusion Type	Site/ Sample	FIA	Thtot	Tfm	Tmice
Quartz 1					
Biphase	4/3	A	151		-6.5
Acqueous	4/3	A	151		-7.8
	4/3	A	151	-49.8	-6.5
	4/3	A	151	-49.8	-11.4
	4/3	A	151	-49.8	-4.8
	4/3	A	156	-50.1	-6.6
	4/3	I	215	-45.5	-7.2
	4/3	I	127		-6.9
Quartz 2					
Monophase	4/3	A	-83		
CH_4	4/3	A	-83		
	4/3	A	-84		
	13/1	A	-88		
	13/1	A	-88		
	13/1	A	-88		
	13/1	A	-88		
	13/1	A	-88		
	13/1	A	-88		
	13/1	A	-87		
	13/1	B	-89		
	13/1	B	-89		
	13/1	B	-89		
	13/1	B	-88		
	13/1	B	-89		
	13/1	B	-88		
	13/1	B	-88		
	13/1	B	-89		
	13/1	B	-88		
	13/1	B	-88		
MC1A					
Calcite	4/2	A	183		-2
	4/2	A	198		-2.8
	4/5	A	190		-2.6
	4/5	A	190		-3
	4/5	A	190		-1.9
	5/2	A	188	-18.4	-2.9
	5/2	A	198	-21.4	-3
	5/2	A	198	-21.4	-2.7
	5/2	A	198	-17.4	-4.9
	5/3	A	183		-2
	5/3	A	183		-2
	5/3	A	178		
	5/6	I	183		-1.5
	5/9	I	194		-0.8
	7/1	A	180		-6
	7/1	A	180		-6.2
	13/1	A	186		
	13/1	A	191		
	13/1	A	186		-1.8
	13/1	A	191		-0.9
	13/1	A	191		
	13/1	I	191		-0.8
MC1B					
Calcite	4/1	A	140		-5.5
	4/1	A	155	-19.9	-3.4
	5/2	A	149	-8.2	-2.1
	5/2	A	149	-8.6	-2
	5/2	A	149	-8	-2
	5/9	A	140	-11.9	-6
	5/9	A	155	-12.1	-6.2
	5/9	A	150		-3.7
	5/9	A	150		-5.4
	5/9	B	150		-2
	5/9	B	150	-31.5	-9.7
	5/9	B	140	-31.5	-10
	5/9	B	140	-31.5	-17.2
	5/9	B	155	-31.5	-14
	13/1	A	156		-1
	13/1	A	156		-1
	13/1	A	156		-0.8
	13/1	A	161		-1
	13/1	A	161		-1
MC2					
Calcite	4/1	A	115	-27.3	-20.7
	4/1	A	115		
	4/5	A	69		-1.7
	4/5	A	69		-1.5
	5/8	A	70	-27.9	-19.8
	5/8	A	70	-27.8	-19.8
	5/8	B	89	-34.5	-18.9
	5/8	B	99	-34.4	-18.6
	5/8	B	114	-34.1	-16.7

	5/9	A	80		-1.8
	5/9	A	70		-1.9
	5/9	A	70		-1.5
	5/9	A	70		-1.3
	7/1	A	90	-17.8	-5.3
	7/1	A	90		-5.3
	7/1	A	90		-5.8
	7/1	A	90		-9.7
	7/1	A	90		-2.5
	13/1	I	108		-12.3
	13/1	I	108		-0.7
OC1 Calcite	10/1	A	90		
	10/1	A	90		
	10/1	I	90		
	10/1	I	90		-0.5
	10/1	I	100		
	10/1	I	100		-0.1
	10/2	A	90		-1.5
	10/2	A	100		
	10/2	I	100		
	9/1	A	100		
	9/1	A	100		
	9/1	A	100		
	9/1	A	105		
	8/2	A	78		
	8/2	A	78		
	8/2	A	113		
	8/2	A	113		
	2/4	A	100		-0.2
	2/4	A			-0.1
	3/4	A	95		
	3/4	A	105		-1.6
	3/4	I	100		-1.5
OC2 Calcite	10/1	A	60		-6.9
	10/1	A	65		-6.5
	10/1	A			-6.3
	10/1	A			-5.9
	10/1	A			-5.2
	10/1	A			-3.4
	10/1	A			-2
	10/2	A	110		-1.9
	10/2	A	110		-1.3
	10/2	A	110		
	10/2	A	110		
	10/2	A	110		
	10/2	A	110		
	10/2	A	110		
	10/2	A	115		
	8/2	I	74		-4.4

SEM-EDS prehnite major elements contents

Al_2O_3	SiO_2	CaO	FeO
25.32	45.40	27.67	-
25.17	45.30	27.78	-
25.14	44.86	27.90	-
24.95	45.23	27.78	0.46
25.27	45.24	27.96	-
25.32	45.44	27.72	-
25.31	45.21	27.89	-
25.14	45.21	27.41	-
24.80	44.74	28.10	-
24.75	45.02	27.66	0.37
24.81	44.91	27.73	0.29
24.79	44.77	28.94	-
25.33	44.76	27.77	-
25.02	45.29	28.09	-
24.91	45.20	27.98	0.44
24.77	44.74	27.45	0.57
25.00	44.68	27.93	0.39
25.33	45.00	27.84	-
24.99	44.80	27.76	0.35
25.10	45.22	27.72	-
25.11	45.34	27.96	-
24.97	45.27	27.60	0.48
25.02	44.92	27.86	-
25.03	44.81	27.90	-
24.56	44.90	27.60	0.52
24.98	44.94	27.72	-
25.00	45.24	27.71	0.33
25.05	45.08	27.49	0.40
25.15	44.98	27.62	-
25.06	44.83	27.75	-
25.01	45.07	27.78	0.52
24.89	45.28	27.78	-
24.98	44.88	27.67	-
25.00	45.13	27.75	0.50
25.03	44.84	27.83	0.28
25.19	44.99	28.05	-
25.22	44.97	27.69	0.35
25.27	45.19	27.76	0.33
25.13	45.01	27.38	-
24.83	45.20	27.79	0.42
24.92	45.26	27.70	-
25.31	45.01	27.85	-
25.48	45.24	27.69	-
25.11	45.09	27.76	0.31
24.94	44.94	27.66	0.35
25.28	44.87	27.59	-
25.04	45.34	27.42	-
25.30	45.02	27.64	-
25.02	44.73	27.59	0.43
25.41	44.82	27.47	-
25.22	45.16	27.76	-
25.02	44.94	27.80	-