Supplementary material for: Exploring the Manufacturing Process of a Renaissance Breach Pike

Paolomarco Merico [1], Michela Faccoli [1,*], Roberto Gotti [2] and Giovanna Cornacchia [1]

[1] Department of Mechanical and Industrial Engineering, University of Brescia, Via Branze 38, 25123 Brescia, Italy; paolomarco.merico@unibs.it (P.M.); giovanna.cornacchia@unibs.it (G.C.)

[2] The Martial Arts Museum, via Garibaldi 3, 25082 Botticino (BS), Italy; roberto@dismastrading.it
* Corresponding: michela.faccoli@unibs.it

Table S1. Elemental chemical composition (wt%) and area (μm²) of each SI analyzed by SEM/EDS

Section	O	Na	Mg	Al	Si	K	Ca	Ti	Mn	Fe	S	P	Area
S2	41.64	0.58	1.98	3.89	16.96	1.13	8.79	0.42	14.66	9.94	0.00	0.00	2106
S2	40.65	0.00	2.32	3.37	18.03	1.49	9.65	0.00	18.61	5.88	0.00	0.00	1077
S2	43.84	0.00	2.63	4.15	19.21	1.77	9.77	0.00	12.66	5.54	0.43	0.00	4457
S2	45.73	0.00	1.57	2.72	15.94	1.12	7.54	0.00	13.27	10.95	0.26	0.91	9227
S2	38.74	0.00	1.94	2.58	14.99	1.44	7.29	0.00	16.50	15.26	0.00	1.26	1356
S2	39.79	0.00	1.77	2.94	13.11	1.62	7.27	0.66	14.26	18.57	0.00	0.00	147886
S2	38.71	0.00	1.21	2.41	11.56	1.40	6.15	0.00	11.53	26.44	0.00	0.59	3892
S2	40.95	0.00	3.38	1.60	15.87	0.66	7.19	0.00	22.07	8.28	0.00	0.00	3099
S2	43.84	0.00	2.14	2.59	16.18	1.34	7.53	0.00	17.57	5.79	1.05	1.96	3674
S2	41.33	0.00	4.98	1.35	16.37	0.60	6.61	0.20	23.52	4.70	0.10	0.26	1486
S2	26.48	0.00	2.48	0.38	2.01	0.34	1.02	0.00	21.17	45.88	0.00	0.25	14630
S2	29.79	0.00	1.46	0.37	3.31	0.35	1.86	0.00	6.85	55.74	0.00	0.27	8311
S2	34.38	0.00	3.27	0.78	11.32	0.00	7.15	2.19	22.25	18.06	0.00	0.59	4280
S2	43.76	0.00	2.46	3.65	18.06	2.22	9.81	0.00	14.09	5.31	0.00	0.65	1172
S2	45.29	0.60	2.88	3.87	20.56	2.03	10.88	0.56	11.12	1.80	0.42	0.00	528
S2	42.96	0.00	2.96	3.75	19.34	1.94	9.91	0.00	13.74	3.79	0.00	0.00	1142
S2	54.07	0.00	2.67	3.82	17.71	1.41	7.43	0.43	10.25	1.87	0.34	0.00	79394
S2	43.15	0.20	3.41	2.54	15.30	1.18	6.49	0.00	13.95	12.87	0.00	0.21	3537
S2	39.10	0.66	1.50	3.80	13.64	1.90	7.62	0.36	13.25	17.02	0.00	1.16	5069
S3	46.71	0.00	1.25	1.96	11.17	1.13	6.31	0.17	10.27	20.78	0.00	0.26	2093
S3	50.06	0.00	1.76	2.38	12.94	1.24	7.14	0.16	13.31	10.60	0.00	0.41	1699
S3	47.86	0.50	1.25	2.33	11.05	1.19	5.81	0.00	10.30	19.37	0.00	0.34	1490
S3	48.67	0.00	1.71	2.20	10.22	1.09	5.78	0.00	10.40	19.47	0.00	0.44	1181
S3	53.04	1.42	2.61	3.25	16.46	1.49	8.14	0.34	11.85	1.41	0.00	0.00	1486
S3	56.80	0.54	2.45	3.28	16.30	1.00	7.81	0.25	10.39	1.18	0.00	0.00	1967
S3	51.65	0.37	2.32	3.02	15.48	1.71	7.94	0.20	14.55	2.76	0.00	0.00	2887
S3	55.43	0.41	3.00	3.54	16.36	1.84	7.94	0.40	9.66	1.42	0.00	0.00	1816
S3	54.97	0.00	2.23	3.03	14.96	1.10	7.66	0.00	12.85	3.20	0.00	0.00	1442
S3	43.27	0.00	0.52	1.45	8.55	0.68	4.82	0.17	6.86	33.33	0.00	0.36	3106
S3	57.11	0.00	2.62	3.60	17.29	1.21	9.11	0.64	6.27	2.15	0.00	0.00	1481
S3	47.50	0.00	1.23	1.99	10.31	1.26	5.58	0.00	10.31	21.62	0.00	0.20	3090
S3	54.25	0.60	2.01	2.55	13.86	1.22	6.87	0.51	14.02	3.87	0.24	0.00	1166
S3	39.24	0.00	1.23	0.29	1.93	0.18	1.14	0.00	5.63	50.03	0.06	0.26	2003
S3	54.28	0.00	1.95	3.15	15.99	1.48	8.31	0.60	12.39	1.31	0.55	0.00	431
S3	55.01	0.37	2.22	2.96	14.63	1.16	7.50	0.25	13.41	2.49	0.00	0.00	1938
S3	60.88	0.00	2.26	2.71	13.37	1.25	5.92	0.00	8.55	5.06	0.00	0.00	3951
S3	56.34	0.00	2.37	3.14	15.09	1.52	6.72	0.00	12.24	2.58	0.00	0.00	1409
S3	54.77	0.51	2.64	3.11	16.11	1.24	8.26	0.00	11.08	2.28	0.00	0.00	1705
S3	49.71	0.00	1.78	2.00	11.40	1.16	6.43	0.32	12.32	14.89	0.00	0.00	1466
S3	50.41	0.00	1.73	2.19	11.81	1.11	5.79	0.18	10.18	16.59	0.00	0.00	2587
S3	52.79	0.00	2.46	3.09	17.34	1.53	9.21	0.31	9.58	3.09	0.60	0.00	1238
S3	50.63	0.00	1.37	2.05	10.59	0.90	5.19	0.00	10.14	17.95	0.22	0.95	541

S3	49.32	0.00	1.64	1.93	10.93	0.99	5.44	0.13	9.76	19.36	0.00	0.50	928
S2	41.64	0.58	1.98	3.89	16.96	1.13	8.79	0.42	14.66	9.94	0.00	0.00	2106
S2	40.65	0.00	2.32	3.37	18.03	1.49	9.65	0.00	18.61	5.88	0.00	0.00	1077
S2	43.84	0.00	2.63	4.15	19.21	1.77	9.77	0.00	12.66	5.54	0.43	0.00	4457
S2	45.73	0.00	1.57	2.72	15.94	1.12	7.54	0.00	13.27	10.95	0.26	0.91	9227
S2	38.74	0.00	1.94	2.58	14.99	1.44	7.29	0.00	16.50	15.26	0.00	1.26	1356
S2	39.79	0.00	1.77	2.94	13.11	1.62	7.27	0.66	14.26	18.57	0.00	0.00	147886
S2	38.71	0.00	1.21	2.41	11.56	1.40	6.15	0.00	11.53	26.44	0.00	0.59	3892
S2	40.95	0.00	3.38	1.60	15.87	0.66	7.19	0.00	22.07	8.28	0.00	0.00	3099
S2	43.84	0.00	2.14	2.59	16.18	1.34	7.53	0.00	17.57	5.79	1.05	1.96	3674
S2	41.33	0.00	4.98	1.35	16.37	0.60	6.61	0.20	23.52	4.70	0.10	0.26	1486
S2	26.48	0.00	2.48	0.38	2.01	0.34	1.02	0.00	21.17	45.88	0.00	0.25	14630
S2	29.79	0.00	1.46	0.37	3.31	0.35	1.86	0.00	6.85	55.74	0.00	0.27	8311
S2	34.38	0.00	3.27	0.78	11.32	0.00	7.15	2.19	22.25	18.06	0.00	0.59	4280
S2	43.76	0.00	2.46	3.65	18.06	2.22	9.81	0.00	14.09	5.31	0.00	0.65	1172
S2	45.29	0.60	2.88	3.87	20.56	2.03	10.88	0.56	11.12	1.80	0.42	0.00	528
S2	42.96	0.00	2.96	3.75	19.34	1.94	9.91	0.00	13.74	3.79	0.00	0.00	1142
S2	54.07	0.00	2.67	3.82	17.71	1.41	7.43	0.43	10.25	1.87	0.34	0.00	79394
S2	43.15	0.20	3.41	2.54	15.30	1.18	6.49	0.00	13.95	12.87	0.00	0.21	3537
S2	39.10	0.66	1.50	3.80	13.64	1.90	7.62	0.36	13.25	17.02	0.00	1.16	5069
S3	46.71	0.00	1.25	1.96	11.17	1.13	6.31	0.17	10.27	20.78	0.00	0.26	2093
S3	50.06	0.00	1.76	2.38	12.94	1.24	7.14	0.16	13.31	10.60	0.00	0.41	1699
S3	47.86	0.50	1.25	2.33	11.05	1.19	5.81	0.00	10.30	19.37	0.00	0.34	1490
S3	48.67	0.00	1.71	2.20	10.22	1.09	5.78	0.00	10.40	19.47	0.00	0.44	1181
S3	53.04	1.42	2.61	3.25	16.46	1.49	8.14	0.34	11.85	1.41	0.00	0.00	1486
S3	56.80	0.54	2.45	3.28	16.30	1.00	7.81	0.25	10.39	1.18	0.00	0.00	1967
S3	51.65	0.37	2.32	3.02	15.48	1.71	7.94	0.20	14.55	2.76	0.00	0.00	2887
S3	55.43	0.41	3.00	3.54	16.36	1.84	7.94	0.40	9.66	1.42	0.00	0.00	1816
S3	54.97	0.00	2.23	3.03	14.96	1.10	7.66	0.00	12.85	3.20	0.00	0.00	1442
S3	43.27	0.00	0.52	1.45	8.55	0.68	4.82	0.17	6.86	33.33	0.00	0.36	3106
S3	57.11	0.00	2.62	3.60	17.29	1.21	9.11	0.64	6.27	2.15	0.00	0.00	1481
S3	47.50	0.00	1.23	1.99	10.31	1.26	5.58	0.00	10.31	21.62	0.00	0.20	3090
S3	54.25	0.60	2.01	2.55	13.86	1.22	6.87	0.51	14.02	3.87	0.24	0.00	1166
S3	39.24	0.00	1.23	0.29	1.93	0.18	1.14	0.00	5.63	50.03	0.06	0.26	2003
S3	54.28	0.00	1.95	3.15	15.99	1.48	8.31	0.60	12.39	1.31	0.55	0.00	431
S3	55.01	0.37	2.22	2.96	14.63	1.16	7.50	0.25	13.41	2.49	0.00	0.00	1938
S3	60.88	0.00	2.26	2.71	13.37	1.25	5.92	0.00	8.55	5.06	0.00	0.00	3951
S3	56.34	0.00	2.37	3.14	15.09	1.52	6.72	0.00	12.24	2.58	0.00	0.00	1409
S3	54.77	0.51	2.64	3.11	16.11	1.24	8.26	0.00	11.08	2.28	0.00	0.00	1705
S3	49.71	0.00	1.78	2.00	11.40	1.16	6.43	0.32	12.32	14.89	0.00	0.00	1466
S3	50.41	0.00	1.73	2.19	11.81	1.11	5.79	0.18	10.18	16.59	0.00	0.00	2587
S3	52.79	0.00	2.46	3.09	17.34	1.53	9.21	0.31	9.58	3.09	0.60	0.00	1238
S3	50.63	0.00	1.37	2.05	10.59	0.90	5.19	0.00	10.14	17.95	0.22	0.95	541
S3	49.32	0.00	1.64	1.93	10.93	0.99	5.44	0.13	9.76	19.36	0.00	0.50	928

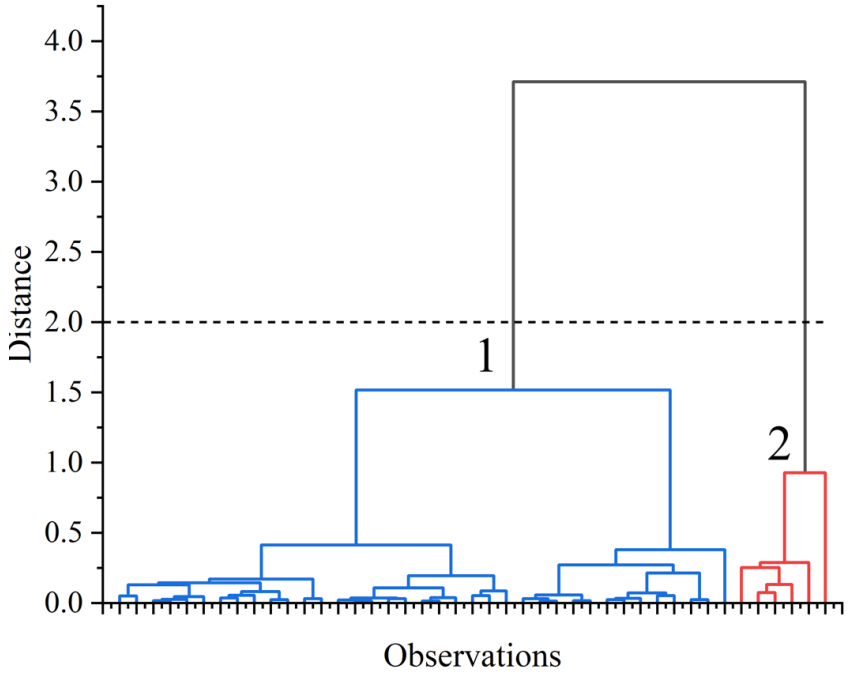


Figure S1. Dendrogram plot resulting from Hierarchical Cluster Analysis (HCA)

Liquidus temperature modelling by MELTS

The liquidus temperatures of smelting-derived SI (group 1) was determined by Rhyolite-MELTS software v.1.0.2 [1,2]. The computation of liquidus temperatures was carried out under atmospheric pressure (1 bar), iron-wüstite (IW) oxygen fugacity buffer starting from a temperature of 1500 °C. MELTS input file for group 1 is labeled as "MELTS INPUT FILE 1". In the input file, compositional data are expressed as weight percentage (wt%).

MELTS INPUT FILE 1

Title: GROUP_1
Initial Composition: SiO2 36.84
Initial Composition: TiO2 0.88
Initial Composition: Al2O3 6.96
Initial Composition: FeO 17.75
Initial Composition: MnO 18.87
Initial Composition: MgO 4.03
Initial Composition: CaO 11.93
Initial Composition: Na2O 0.07
Initial Composition: K2O 2.08
Initial Temperature: 1400.00
Final Temperature: 1000.00
Initial Pressure: 1.00
Final Pressure: 1.00
Increment Temperature: 10.00
Increment Pressure: 0.00
dp/dt: 0.00
log fo2 Path: IW

References

1. Ghiorso, M.S.; Gualda, G.A.R. An H2O–CO2 Mixed Fluid Saturation Model Compatible with Rhyolite-MELTS. Contributions to Mineralogy and Petrology 2015, 169, 1–30.
2. Gualda, G.A.R.; Ghiorso, M.S.; Lemons, R. V.; Carley, T.L. Rhyolite-MELTS: A Modified Calibration of MELTS Optimized for Silica-Rich, Fluid-Bearing Magmatic Systems. Journal of Petrology 2012, 53, 875–890.