

X	λ [Å]	E.P. [eV]	$\log gf$	EW [mÅ]		
				UMI396	UMI718	UMI446
O	6300.31	0.00	-9.780	34.6	-	-
Mg	4571.10	0.00	-5.623	-	123.6	93.5
Mg	4702.99	4.34	-0.440	98.9	111.2	91.1
Mg	5528.41	4.34	-0.498	132.4	107.8	-
Mg	5711.09	4.34	-1.724	36.3	-	-
Si	7423.50	5.62	-0.314	30.8	-	-
Ca	4435.69	1.89	-0.519	-	-	72.7
Ca	4454.78	1.90	0.260	-	116.0	-
Ca	5349.46	2.71	-1.244	-	50.8	-
Ca	5581.97	2.52	-0.710	41.6	-	-
Ca	5588.76	2.52	0.210	90.9	98.6	54.1
Ca	5590.12	2.52	-0.710	47.2	-	-
Ca	5594.48	2.52	-0.050	-	88.6	48.0
Ca	5598.49	2.52	-0.220	64.4	-	-
Ca	5601.29	2.52	-0.690	42.4	-	-
Ca	5857.45	2.93	0.230	-	67.2	-
Ca	6102.72	1.88	-0.790	99.2	102.3	-
Ca	6122.22	1.89	-0.315	128.3	115.1	108.0
Ca	6162.17	1.90	0.089	155.1	109.7	-
Ca	6169.56	2.52	-0.270	60.6	65.8	98.0
Ca	6439.07	2.52	0.470	115.9	107.1	68.4
Ca	6449.81	2.52	-0.550	55.3	-	-
Ca	6471.66	2.52	-0.590	57.6	-	-
Ca	6493.78	2.52	0.140	75.4	68.8	-
Ca	6717.69	2.71	-0.590	50.8	54.9	-
Ca	7148.15	2.71	0.208	100.3	67.1	-
Ca	7326.15	2.93	0.073	53.4	44.8	-
Sc II	4670.41	1.36	-0.580	89.9	70.6	-
Sc II	5239.81	1.45	-0.770	57.6	52.1	-
Sc II	5318.40	1.36	-2.010	14.5	-	-
Sc II	5526.81	1.77	0.130	88.6	82.3	73.1
Sc II	5641.00	1.50	-1.130	44.6	-	-
Sc II	5657.91	1.51	-0.600	-	72.8	79.2
Sc II	5667.16	1.50	-1.310	31.1	-	-
Sc II	5669.06	1.50	-1.200	34.1	33.6	-
Sc II	5684.20	1.51	-1.050	62.9	-	45.3
Sc II	6279.76	1.50	-1.210	38.6	-	-
Sc II	6604.58	1.36	-1.310	32.1	-	-
Ti	4457.43	1.46	0.180	-	54.4	-
Ti	4512.73	0.84	-0.480	73.4	-	46.4
Ti	4518.02	0.83	-0.324	68.9	58.1	-
Ti	4533.24	0.85	0.476	121.3	-	-
Ti	4534.77	0.84	0.280	99.8	-	-
Ti	4548.74	0.83	-0.350	64.3	-	-
Ti	4656.47	0.00	-1.283	119.9	50.0	52.1
Ti	4681.91	0.05	-1.009	90.0	88.4	-
Ti	4885.08	1.89	0.358	30.7	-	-
Ti	4913.61	1.87	0.161	37.7	-	-
Ti	4981.73	0.85	0.504	143.5	112.9	88.0
Ti	4991.07	0.84	0.380	160.6	-	-
Ti	4999.50	0.83	0.250	132.9	99.2	82.8
Ti	5009.65	0.02	-2.197	41.0	-	-
Ti	5016.16	0.85	-0.574	61.1	-	-
Ti	5022.88	0.83	-0.434	71.9	-	-
Ti	5020.03	0.74	-0.415	-	56.2	-
Ti	5022.86	0.83	-0.434	-	51.1	55.2
Ti	5024.84	0.82	-0.602	45.6	54.0	-
Ti	5036.46	1.44	0.130	51.9	-	-
Ti	5038.40	1.43	0.013	45.9	-	-
Ti	5039.96	0.02	-1.068	114.0	64.3	-

Ti	5064.67	0.05	-0.929	-	87.0	57.1
Ti	5145.46	1.46	-0.574	29.6	-	-
Ti	5147.48	0.00	-1.890	46.9	-	-
Ti	5173.74	0.00	-1.070	127.0	84.9	-
Ti	5192.97	0.02	-0.960	125.9	-	-
Ti	5210.39	0.05	-0.850	132.1	86.4	103.9
Ti	6258.10	1.44	-0.355	33.3	-	-
Ti	6258.71	1.46	-0.240	32.8	34.0	-
Ti II	4443.80	1.08	-0.717	-	158.6	126.5
Ti II	4444.56	1.12	-2.030	79.9	92.6	59.8
Ti II	4450.48	1.08	-1.518	118.4	117.8	-
Ti II	4464.46	1.16	-2.080	95.1	-	-
Ti II	4468.50	1.13	-0.620	175.3	149.6	-
Ti II	4469.20	1.08	-2.335	67.0	-	-
Ti II	4470.86	1.16	-2.280	60.0	-	-
Ti II	4501.27	1.12	-0.767	-	157.4	127.2
Ti II	4529.48	1.57	-1.638	-	-	74.2
Ti II	4544.02	1.24	-2.410	-	66.2	-
Ti II	4563.76	1.22	-0.960	147.6	-	-
Ti II	4568.32	1.22	-2.650	53.8	136.2	149.8
Ti II	4589.95	1.24	-1.780	103.3	104.7	61.3
Ti II	4657.20	1.24	-2.150	-	-	92.3
Ti II	4708.67	1.24	-2.310	74.7	-	60.3
Ti II	4798.53	1.08	-2.679	65.7	55.0	-
Ti II	4805.10	2.06	-1.120	94.4	-	-
Ti II	4865.62	1.12	-2.788	67.4	47.7	-
Ti II	5013.69	1.58	-2.185	-	-	60.9
Ti II	5129.15	1.89	-1.239	93.7	-	85.0
Ti II	5154.07	1.57	-1.920	85.2	68.0	66.0
Ti II	5185.90	1.89	-1.487	68.7	68.3	-
Ti II	5188.69	1.58	-1.220	-	-	86.9
Ti II	5226.54	1.57	-1.290	-	-	113.5
Ti II	5336.80	1.58	-1.700	93.8	86.8	-
Cr	4496.86	0.94	-1.150	-	-	51.1
Cr	4545.96	0.94	-1.380	63.2	-	-
Cr	4580.06	0.94	-1.640	62.7	61.7	-
Cr	4600.76	1.00	-1.260	-	89.8	44.2
Cr	4616.14	0.98	-1.180	85.7	85.5	-
Cr	4646.17	1.03	-0.710	101.9	-	-
Cr	4626.19	0.97	-1.320	-	67.5	-
Cr	4651.29	0.98	-1.460	58.4	44.2	-
Cr	4652.16	1.00	-1.030	81.7	79.6	-
Cr	5206.04	0.94	0.019	-	-	132.0
Cr	5247.57	0.96	-1.630	60.6	66.1	-
Cr	5296.69	0.98	-1.410	85.8	60.8	-
Cr	5298.29	0.98	-1.160	89.8	77.5	56
Cr	5300.75	0.98	-2.130	36.2	-	-
Cr	5345.81	1.00	-0.980	105.2	-	65.2
Cr	5348.32	1.00	-1.290	91.4	68.7	-
Cr	5409.80	1.03	-0.720	128.7	106.9	87.4
Mn	4451.59	2.89	0.278	-	-	50.9
Mn	4754.04	2.28	-0.085	72.6	71.7	-
Mn	4762.38	2.89	0.426	-	-	62.3
Mn	4766.42	2.92	0.100	-	-	37.9
Mn	4783.40	2.30	0.042	90.4	103.4	-
Mn	4823.51	2.32	0.144	-	79.5	70.6
Mn	5394.67	0.00	-3.503	-	-	43.0
Fe	4442.34	2.20	-1.250	-	119.0	-
Fe	4443.21	2.86	-1.043	76.5	87.3	41.2
Fe	4445.47	0.09	-5.441	85.9	-	-
Fe	4447.72	2.22	-1.340	-	122.0	-
Fe	4454.38	2.83	-1.299	-	77.8	55.2

Fe	4461.66	0.09	-3.210	-	146.3	115.4
Fe	4466.55	2.83	-0.600	-	-	76.8
Fe	4489.75	0.12	-3.970	-	130.0	-
Fe	4494.57	2.20	-1.140	143.4	-	121.0
Fe	4531.15	1.48	-2.155	-	-	96.8
Fe	4592.66	1.5	-2.449	-	-	106.6
Fe	4598.12	3.28	-1.570	73.2	-	-
Fe	4602.00	1.61	-3.154	100.1	-	-
Fe	4602.95	1.48	-2.220	125.5	124.4	121.1
Fe	4625.03	3.24	-1.348	55.9	-	-
Fe	4630.13	2.28	-2.587	81.7	-	-
Fe	4637.52	3.28	-1.340	75.7	53.6	-
Fe	4647.44	2.95	-1.351	77.1	88.2	-
Fe	4678.87	3.60	-0.833	66.2	-	63.0
Fe	4733.59	1.48	-2.987	127.3	81.1	66.5
Fe	4736.77	3.21	-0.752	94.2	-	-
Fe	4859.75	2.87	-0.764	104.8	96.2	104.1
Fe	4871.33	2.86	-0.360	143.8	116.6	-
Fe	4872.14	2.83	-0.570	131.5	124.2	81.1
Fe	4878.20	2.88	-0.888	133.0	-	101.6
Fe	4890.76	2.87	-0.394	148.0	134.6	90.3
Fe	4891.50	2.85	-0.110	157.4	133.4	135.4
Fe	4903.32	2.88	-0.926	-	-	99.0
Fe	4910.01	3.40	-1.539	49.7	-	-
Fe	4919.00	2.86	-0.340	137.5	122.3	112.0
Fe	4924.77	2.28	-2.114	106.0	60.4	60.0
Fe	4938.82	2.87	-1.077	98.0	80.0	-
Fe	4939.69	0.86	-3.340	155.9	111.1	118.6
Fe	4946.40	3.37	-1.170	59.0	64.4	-
Fe	4957.30	2.85	-0.408	-	127.2	-
Fe	4966.10	3.33	-0.871	93.6	-	-
Fe	4982.50	4.10	0.144	80.6	67.2	-
Fe	4983.23	4.15	-0.158	45.2	-	-
Fe	4983.85	4.10	-0.068	54.7	63.0	44.6
Fe	4994.13	0.91	-3.080	-	-	95.5
Fe	5001.87	3.88	-0.010	77.3	76.9	42.5
Fe	5002.80	3.40	-1.530	55.1	-	-
Fe	5005.71	3.88	-0.180	83.4	-	-
Fe	5006.12	2.83	-0.615	130.6	113.0	82.6
Fe	5012.07	0.86	-2.642	-	-	124.1
Fe	5014.95	3.94	-0.303	76.9	57.2	-
Fe	5022.25	3.98	-0.560	59.1	-	-
Fe	5041.08	0.96	-3.087	140.2	129.1	120.6
Fe	5041.76	1.48	-2.203	-	-	115.7
Fe	5049.82	2.28	-1.355	-	113.1	106.7
Fe	5051.63	0.91	-2.795	-	134.5	112.2
Fe	5068.77	2.94	-1.042	105.2	79.9	64.1
Fe	5074.75	4.22	-0.230	-	46.7	-
Fe	5079.22	2.20	-2.067	118.2	-	47.0
Fe	5079.74	0.99	-3.220	-	-	70.1
Fe	5083.34	0.96	-2.958	-	137.7	94.3
Fe	5098.70	2.18	-2.026	124.9	-	58.7
Fe	5044.21	2.85	-2.017	59.9	-	-
Fe	5096.99	4.28	-0.277	43.0	-	-
Fe	5110.41	0.00	-3.760	-	-	100.2
Fe	5123.72	1.01	-3.068	-	128.6	84.6
Fe	5125.14	4.22	-0.140	45.8	-	-
Fe	5127.36	0.91	-3.307	-	113.4	-
Fe	5131.48	2.22	-2.515	78.8	-	-
Fe	5139.25	3.00	-0.741	-	-	66.1
Fe	5139.46	2.94	-0.509	-	-	107.3
Fe	5142.93	0.96	-3.067	150.9	-	-

Fe	5141.75	2.42	-2.238	85.9	55.9	-
Fe	5151.91	1.01	-3.322	126.1	-	78.8
Fe	5162.28	4.18	0.080	71.9	72.9	-
Fe	5166.28	0.00	-4.195	-	126.9	110.3
Fe	5171.60	1.48	-1.793	-	148.3	139.2
Fe	5192.34	3.00	-0.421	135.4	-	101.0
Fe	5194.94	1.56	-2.090	157.2	131.1	109.1
Fe	5195.47	4.22	-0.002	60.9	-	-
Fe	5198.71	2.22	-2.140	104	81.4	-
Fe	5215.19	3.26	-0.871	84.4	81.5	42.8
Fe	5216.28	1.61	-2.150	157.2	137.5	-
Fe	5217.37	3.21	-1.070	67.0	86.0	-
Fe	5225.54	0.11	-4.789	124.5	-	-
Fe	5227.19	1.56	-1.228	-	-	144.9
Fe	5232.96	2.94	-0.057	139.0	149.4	106.8
Fe	5247.06	0.09	-4.946	115.2	85.4	-
Fe	5250.22	0.12	-4.938	120.3	85.4	-
Fe	5250.66	2.20	-2.050	102.9	81.1	49
Fe	5263.31	3.26	-0.879	89.9	-	-
Fe	5283.62	3.24	-0.525	-	-	82.0
Fe	5302.32	3.28	-0.720	98.0	-	-
Fe	5307.38	1.61	-2.987	114.9	85.3	52.2
Fe	5324.18	3.21	-0.103	-	-	78.1
Fe	5328.53	1.56	-1.850	-	-	110.3
Fe	5332.90	1.56	-2.776	114.9	81.2	73.7
Fe	5339.94	3.26	-0.720	93.8	80.1	45.3
Fe	5364.91	4.44	0.228	69.4	-	-
Fe	5367.46	4.41	0.443	92.4	-	-
Fe	5383.38	4.31	0.645	82.8	72.5	74.4
Fe	5393.18	3.24	-0.715	98.4	99.3	-
Fe	5404.14	4.31	0.523	82.2	-	-
Fe	5405.78	0.99	-1.844	-	-	139.3
Fe	5410.91	4.47	0.398	62.7	52.1	-
Fe	5415.19	4.39	0.640	75.1	65.9	-
Fe	5434.52	1.01	-2.122	-	158.0	153.4
Fe	5445.05	4.39	-0.030	61.1	-	-
Fe	5497.52	1.01	-2.849	-	124.8	137.1
Fe	5501.47	0.96	-3.047	154.5	133.2	124.9
Fe	5506.78	0.99	-2.797	-	145.5	122.0
Fe	5567.40	2.61	-2.670	49.9	-	-
Fe	5569.62	3.42	-0.486	86.3	-	72.2
Fe	5572.84	3.40	-0.275	111.1	88.6	71.1
Fe	5576.10	3.43	-0.920	77.7	-	-
Fe	5586.76	3.37	-0.140	-	127.3	68.5
Fe	5624.53	3.42	-0.755	-	95.2	-
Fe	5662.53	4.18	-0.573	49.6	-	-
Fe	5701.56	2.56	-2.140	70.3	50.4	-
Fe	5763.00	4.21	-0.470	59.6	-	-
Fe	6024.06	4.55	0.030	-	39.2	-
Fe	6065.49	2.61	-1.410	126.5	105.1	46.4
Fe	6136.64	2.45	-1.410	140.4	-	-
Fe	6137.02	2.20	-2.950	56.5	-	-
Fe	6137.70	2.59	-1.350	135.4	119.3	-
Fe	6191.56	2.43	-1.420	-	128.7	85.6
Fe	6200.33	2.61	-2.370	49.7	-	-
Fe	6213.44	2.22	-2.482	87.8	81.1	-
Fe	6219.30	2.22	-2.433	97.1	87.2	-
Fe	6230.76	2.56	-1.281	153.3	-	-
Fe	6240.69	2.22	-3.170	57.7	-	-
Fe	6246.33	3.60	-0.880	81.1	-	-
Fe	6252.55	2.40	-1.770	126.5	106.1	86.9
Fe	6254.25	2.28	-2.426	-	75.2	-

Fe	6256.36	2.45	-2.408	-	71.1	-
Fe	6265.14	2.18	-2.540	97.7	72.8	-
Fe	6280.61	0.86	-4.390	92.2	64.3	-
Fe	6297.81	2.22	-2.640	-	72.2	-
Fe	6301.52	3.6	-0.718	67.5	74.3	-
Fe	6318.03	2.45	-1.804	-	88.1	-
Fe	6322.69	2.59	-2.426	-	42.0	-
Fe	6335.35	2.20	-2.177	118.5	83.1	-
Fe	6336.85	3.69	-0.856	60.2	-	-
Fe	6344.19	2.43	-2.923	50.2	-	-
Fe	6355.03	2.84	-2.290	-	46.0	-
Fe	6358.69	0.86	-4.468	88.3	68.3	-
Fe	6393.60	2.43	-1.580	123.9	99.9	91.9
Fe	6421.37	2.28	-2.010	126.6	102.0	96
Fe	6400.01	3.60	-0.290	105.9	-	-
Fe	6400.33	0.91	-4.318	101.8	-	-
Fe	6408.03	3.69	-1.020	44.5	52.2	-
Fe	6411.66	3.65	-0.720	77.4	-	-
Fe	6481.87	2.28	-3.010	45.7	-	-
Fe	6494.99	2.40	-1.240	151.9	117.0	113.0
Fe	6498.93	0.96	-4.690	63.4	-	-
Fe	6546.25	2.76	-1.536	102.1	94.5	-
Fe	6574.25	0.99	-5.004	45.0	-	-
Fe	6592.92	2.73	-1.470	117.3	94.8	63.5
Fe	6593.89	2.43	-2.370	82.2	51.9	-
Fe	6663.44	2.42	-2.479	81.5	-	-
Fe	6750.15	2.42	-2.580	61.0	-	-
Fe	6945.23	2.42	-2.482	89.6	-	-
Fe	6978.86	2.48	-2.450	72.8	53.7	-
Fe	7411.18	4.28	-0.280	54.5	-	-
Fe II	4491.41	2.85	-2.600	72.7	-	-
Fe II	4508.30	2.85	-2.280	92.9	-	-
Fe II	4549.47	2.83	-1.730	-	-	81.0
Fe II	4555.89	2.83	-2.250	-	-	61.0
Fe II	4576.34	2.83	-2.900	-	54.0	35.2
Fe II	4583.83	2.81	-2.020	-	116.8	-
Fe II	4923.95	2.89	-1.320	134.3	129.3	-
Fe II	5018.44	2.89	-1.350	-	-	121.3
Fe II	5197.59	3.23	-2.230	64.3	83.0	63.2
Fe II	5234.63	3.22	-2.220	76.6	78.4	-
Fe II	5275.99	3.20	-1.900	-	-	48.1
Fe II	5284.11	2.89	-3.200	42.1	-	-
Fe II	5316.61	3.15	-1.780	-	-	80.7
Ni	4648.69	3.42	-0.150	46.9	52.6	-
Ni	4714.42	3.38	0.230	-	-	49.8
Ni	4756.52	3.48	-0.340	-	40.4	-
Ni	4806.99	3.68	-0.640	19.5	-	-
Ni	4829.02	3.54	-0.330	-	49.4	-
Ni	4866.25	3.54	0.070	44.0	-	-
Ni	4904.41	3.54	-0.170	40.9	43.1	-
Ni	4937.35	3.61	-0.400	-	44.3	-
Ni	4976.33	1.68	-3.100	31.9	-	-
Ni	4980.17	3.61	-0.110	-	47.8	-
Ni	5017.58	3.54	-0.080	59.8	-	-
Ni	5035.37	3.63	0.290	68.5	70.6	47.3
Ni	5080.55	3.65	0.130	49.9	50.8	-
Ni	5081.11	3.85	0.300	54.2	-	-
Ni	5084.10	3.68	0.030	40.4	41.6	-
Ni	5099.93	3.68	-0.100	31.2	34.4	31.3
Ni	5115.39	3.83	-0.110	33.7	-	-
Ni	5137.07	1.68	-1.990	90.6	78.0	-
Ni	5424.65	1.95	-2.770	40.8	-	-

Ni	5476.91	1.83	-0.890	-	-	125.9
Ni	5578.72	1.68	-2.640	43.6	-	-
Ni	5754.67	1.93	-2.340	-	51.4	-
Ni	6108.12	1.68	-2.440	72.3	-	-
Ni	6191.16	1.68	-2.353	85.8	-	-
Ni	6314.65	1.93	-1.770	-	60.9	-
Ni	6327.59	1.68	-3.150	40.4	-	-
Ni	6482.79	1.93	-2.630	33.4	-	-
Ni	6586.32	1.95	-2.810	26.0	-	-
Ni	6643.63	1.68	-2.300	-	78.1	-
Ni	6767.77	1.83	-2.170	89.5	-	48.4
Ni	7122.19	3.54	0.040	-	52.4	-
Ni	7409.35	3.80	-0.100	22.3	43.0	-
Ni	7414.51	1.99	-2.570	63.7	43.0	-
Ni	7422.28	3.63	-0.130	52.1	50.2	-
Cu	5105.55	1.39	-1.500	-	54.3	35.8
Zn	4722.16	4.03	-0.338	37.3	35.1	-
Zn	4810.53	4.08	-0.137	-	34.8	-
Y II	4883.69	1.08	0.070	59.7	59.3	-
Y II	5087.42	1.08	-0.160	-	29.2	-
Y II	5200.41	0.99	-0.600	36.2	-	24.3
Y II	5205.73	1.03	-0.340	48.5	43.7	-
Ba II	4554.03	0.00	0.140	-	134.5	72.1
Ba II	5853.68	0.60	-0.908	-	63.5	-
Ba II	6141.71	0.70	-0.032	110.5	91.3	141.0
Ba II	6496.90	0.60	-0.407	115.4	28.8	144.4
Ce II	4562.37	0.48	0.081	35.6	36.0	-
Ce II	4628.16	0.52	0.260	33.4	-	-
Nd II	4462.99	0.56	-0.070	-	-	30.2
Nd II	5092.83	0.38	-0.610	26.0	-	-
Nd II	5249.59	0.98	0.800	37.9	-	-
Nd II	5319.81	0.55	-0.170	41.8	-	-
Sm II	4519.65	0.54	-0.751	25.7	-	-
Sm II	4523.90	0.43	-0.992	25.0	-	-
Sm II	4566.20	0.33	-1.245	18.4	-	-

Table 1: Equivalent width measurements. columns are: (1) Element; (2) Wavelength of the absorption line; (3) Excitation energy of the lower energy level; (4) Oscillator strength; (5,6,7) Equivalent width of the line measured for each star.