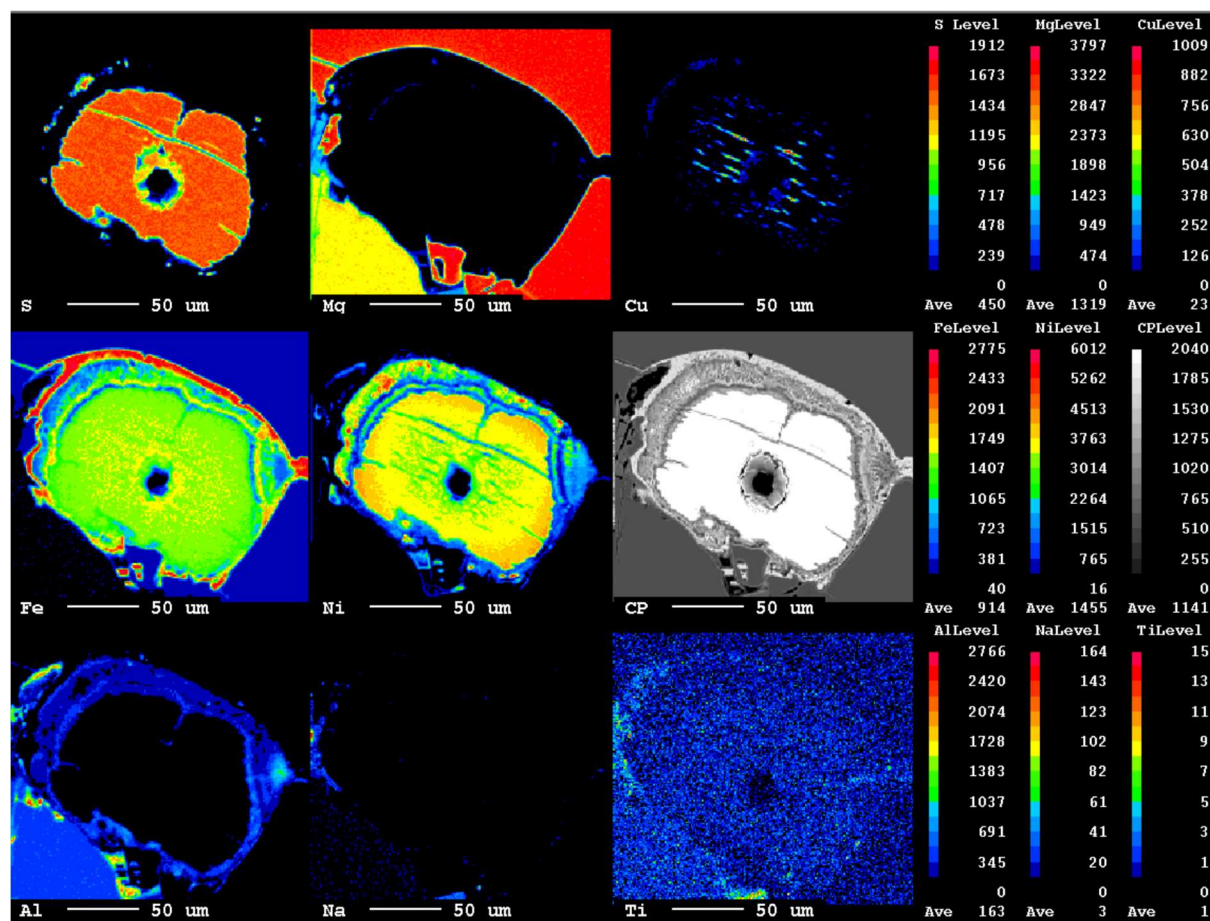
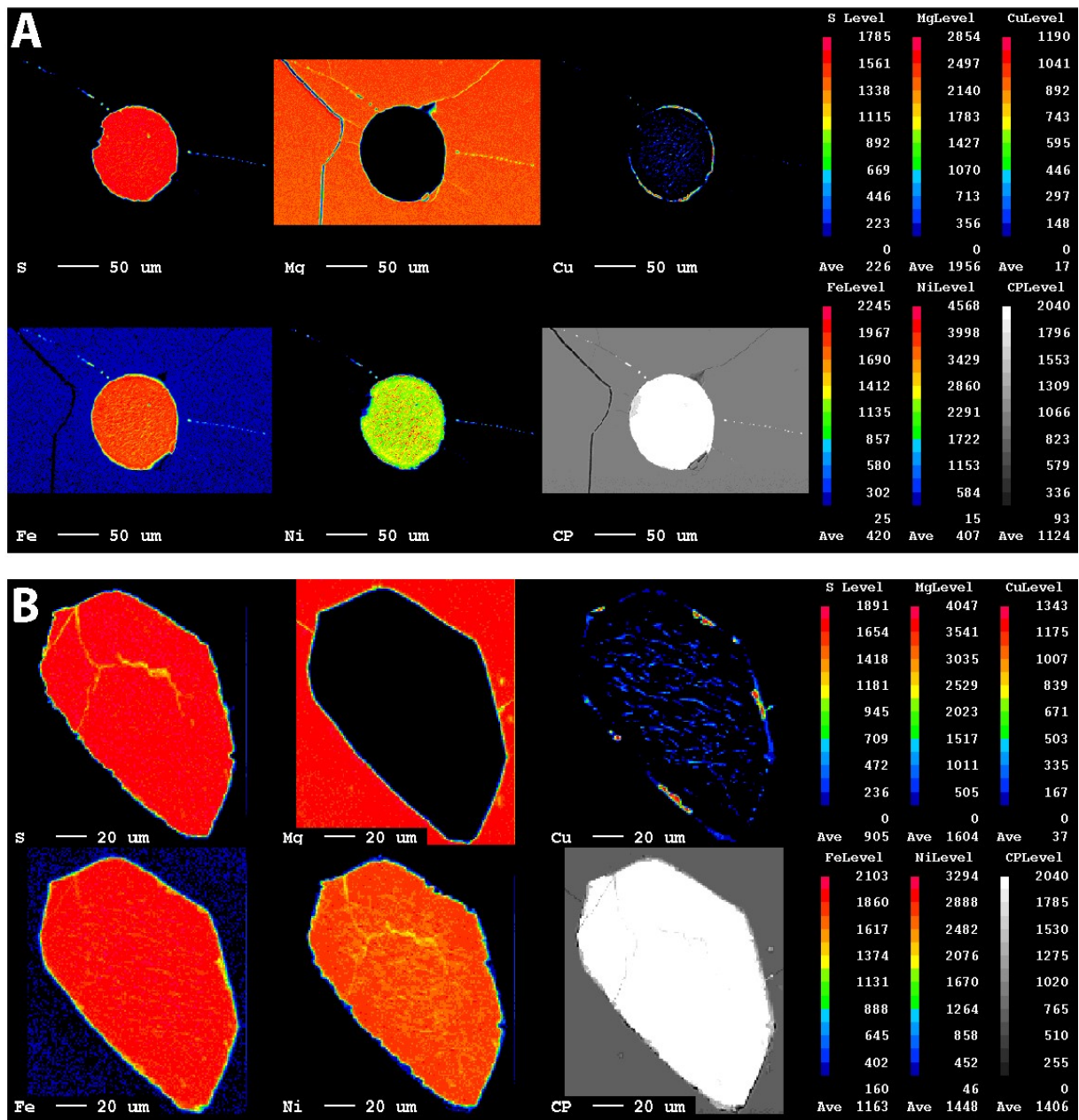


## Supplementary Materials



**Figure S1.** Elemental mapping showing relative abundances of S, Mg, Cu, Fe, Ni, Al, Na and Ti of a mss grain (3t-11, group 3) with Cu-rich exsolution lamellae and break-down to Fe-hydroxides. Note that the outer rim of the Fe-hydroxide phase is enriched in Fe and depleted in Al.



**Figure S2.** Elemental mapping showing relative abundances of S, Mg, Cu, Fe and Ni in addition to a BSE image of a mss droplet (3e-14, group 2) enclosed in olivine (**A**). Note the Ni-Cu-enriched exsolution lamellae at the expense of Fe and the sulphide melt track traversing the host silicate. Cu also is enriched at the rim of the grain, which partially is weathered to Fe-hydroxide. Panel (**B**) shows a euhedral mss grain (3a-4, group 1) enclosed in olivine, which shows Cu enrichment in the exsolution lamellae and several areas at the rim.

**Table S1.** Complete dataset of Middle Atlas mss major element composition and atomic Ni/(Ni + Fe) and metal/sulfur (M/S) ratios. Textural occurrence types are denoted as enclosed [e], interstitial [i] and associated with melt pockets [m]. Exsolution phenomena of Cu- and Ni-enriched lamellae and presence of pentlandite (abbreviated as pn) within the same grain is marked with “x” as abundant.

Sample	EMP analysis #	type	Cu-rich l.	Ni-rich l.	associated with pn	Fe [wt %]	Ni [wt %]	Cu [wt %]	S [wt %]	Total [wt %]	Ni/(Ni+Fe) <sub>at</sub>	M/S <sub>at</sub>
Atl-3A	3a-5-20	i	-	-	-	34.33	26.83	-	39.63	100.80	0.43	0.87
Atl-3A	3a-20-60	m	-	-	-	33.62	26.81	-	38.97	99.40	0.43	0.87
Atl-3A	3a-17-48	i	-	-	-	35.89	25.05	-	39.24	100.26	0.40	0.87
Atl-3A	3a-11-37	i	-	-	-	44.30	17.36	-	39.44	101.19	0.27	0.89
Atl-3A	3a-11-36	i	-	-	-	44.23	17.37	0.24	39.43	101.27	0.27	0.89
Atl-3A	3a-1-1	i	-	-	-	35.05	26.12	0.12	38.73	100.02	0.41	0.89
Atl-3A	3a-20-63	m	-	-	-	43.04	17.76	-	38.47	99.33	0.28	0.90
Atl-3A	3a-20-62	m	-	-	-	43.54	16.99	-	38.24	98.79	0.27	0.90
Atl-3A	3a-15-46	i	-	-	-	33.48	28.61	-	38.81	100.97	0.45	0.90
Atl-3A	3a-11-41	e	-	-	-	34.19	27.42	-	38.27	99.92	0.43	0.90
Atl-3A	3a-19-59	e	-	-	-	42.69	17.27	0.15	37.56	97.67	0.28	0.91
Atl-3A	3a-15-47	i	-	-	-	33.03	29.16	0.11	38.39	100.69	0.46	0.91
Atl-3A	3a-20-67	i	-	-	-	48.13	13.73	-	38.43	100.32	0.21	0.91
Atl-3A	3a-11-32	m	-	-	-	39.98	22.41	0.10	38.12	100.61	0.35	0.92
Atl-3A	3a-3-13	e	x	-	-	45.37	16.69	0.21	37.97	100.24	0.26	0.93
Atl-3A	3a-4-15	e	x	-	-	45.04	16.88	0.41	37.88	100.21	0.26	0.93
Atl-3A	3a-6-22	i	-	-	-	47.07	15.06	-	37.83	99.98	0.23	0.93
Atl-3A	3a-18-52	m	-	-	-	48.05	14.44	-	37.84	100.39	0.22	0.94
Atl-3A	3a-4-14	e	x	-	-	45.92	16.89	0.27	37.91	100.99	0.26	0.94
Atl-3A	3a-18-53	m	-	-	-	47.73	14.76	-	37.62	100.17	0.23	0.94
Atl-3A	3a-6-23	i	-	-	-	44.90	13.28	5.14	37.50	100.82	0.22	0.95
Atl-3B	3b-6a-87	i	-	x	-	46.05	15.29	0.14	38.78	100.27	0.24	0.90
Atl-3B	3b-13-103	i	-	-	x	59.82	2.08	-	39.38	101.37	0.03	0.90
Atl-3B	Atl-3b-11	e	-	-	-	43.47	17.40	-	38.14	99.03	0.28	0.90
Atl-3B	Atl-3b-20	e	-	-	x	46.75	14.33	-	38.29	99.37	0.23	0.91
Atl-3B	3b-6a-86	i	-	x	-	47.05	14.99	-	38.81	100.94	0.23	0.91
Atl-3B	3b-6a-85	i	-	x	-	45.10	17.05	-	38.55	100.74	0.26	0.91
Atl-3B	Atl-3b-17	e	-	-	-	53.81	7.06	-	38.02	98.90	0.11	0.91
Atl-3B	3b-5b-75	i	-	-	x	56.53	4.62	0.30	38.38	99.83	0.07	0.92
Atl-3B	Atl-3b-10	e	-	-	-	44.00	17.45	-	37.99	99.48	0.27	0.92
Atl-3B	Atl-3b-15	e	-	-	-	44.03	17.46	-	37.91	99.40	0.27	0.92
Atl-3B	3b-5b-74	i	-	-	x	59.46	2.45	-	38.63	100.59	0.04	0.92
Atl-3B	Atl-3b-7	e	-	-	-	40.57	18.54	-	36.23	95.42	0.30	0.92

Atl-3B	Atl-3b-6	e	-	-	-	42.68	13.64	5.29	37.14	98.75	0.23	0.93
Atl-3B	3b-17a-106	i	-	-	x	53.10	9.65	0.17	38.04	100.97	0.15	0.94
Atl-3B	3b-5b-73	i	-	-	x	53.17	9.97	0.17	37.72	101.04	0.15	0.96
Atl-3B	Atl-3b-21	e	-	-	x	43.66	19.90	0.16	36.38	100.10	0.30	0.99
Atl-3C	3c-8-18	i	-	x	-	45.72	16.01	-	38.26	100.07	0.25	0.92
Atl-3C	3c-2-4	m	-	-	-	40.88	21.17	-	38.06	100.11	0.33	0.92
Atl-3C	3c-5-15	m	-	-	-	45.70	16.35	-	38.12	100.17	0.25	0.92
Atl-3C	3c-8-19	i	-	x	-	45.42	16.86	0.11	37.61	100.00	0.26	0.94
Atl-3C	3c-4-9	m	-	-	-	38.67	23.87	-	37.38	100.01	0.37	0.94
Atl-3C	3c-10-21	e	-	-	-	47.85	14.77	-	37.42	100.10	0.23	0.95
Atl-3C	3c-9-20	m	-	x	-	45.47	17.19	-	37.18	99.92	0.26	0.96
Atl-3C	3c-1-3	m	-	-	-	44.81	17.68	-	35.87	98.42	0.27	0.99
Atl-3E	3e-1-70	i	-	-	-	31.70	28.95	-	38.61	99.26	0.46	0.88
Atl-3E	3e-8-106	e	-	-	-	38.88	21.11	-	38.34	98.34	0.34	0.88
Atl-3E	3e-1-71	i	-	-	-	31.31	29.30	-	38.04	98.65	0.47	0.89
Atl-3E	3e-8-92	e	-	-	-	45.70	15.18	-	38.60	99.56	0.24	0.90
Atl-3E	3e-16-109	i	-	-	-	34.92	26.83	-	38.67	100.47	0.42	0.90
Atl-3E	3e-8-89	i	-	-	-	45.77	15.58	-	38.52	99.87	0.24	0.90
Atl-3E	3e-2-81	i	x	-	-	47.68	14.20	-	38.24	100.16	0.22	0.92
Atl-3E	3e-2-80	i	x	-	-	47.35	14.31	0.11	38.00	99.77	0.22	0.92
Atl-3E	3e-6-85	e	-	-	-	42.97	19.35	-	38.02	100.38	0.30	0.93
Atl-3E	3e-8-103	i	x	-	-	48.14	14.16	-	38.10	100.47	0.22	0.93
Atl-3E	3e-8-104	i	x	-	-	48.97	13.05	0.18	37.80	100.00	0.20	0.93
Atl-3K	3k-17-49	m	-	x	-	41.63	19.24	-	38.99	99.86	0.31	0.88
Atl-3K	3k-8-44	e	-	-	-	45.33	15.25	-	38.68	99.25	0.24	0.89
Atl-3K	3k-9-47	m	-	x	-	41.45	20.60	-	38.23	100.29	0.32	0.92
Atl-3K	3k-9-45	i	-	x	-	43.33	18.68	-	37.99	100.03	0.29	0.92
Atl-3K	3k-9-46	i	-	x	-	39.96	24.30	-	36.71	101.01	0.37	0.99
Atl-3K	3k-5-35	e	-	x	-	40.34	24.04	-	35.28	99.72	0.36	1.03
Atl-3T	3t-11-78	m	x	-	-	38.57	21.36	0.37	38.54	98.83	0.35	0.88
Atl-3T	3t-13-79	e	-	-	-	34.73	26.42	0.21	38.78	100.13	0.42	0.89
Atl-3T	3t-11-77	m	x	-	-	38.44	22.23	0.35	38.64	99.65	0.35	0.89
Atl-3T	3t-8-74	m	-	-	-	36.89	24.05	0.50	38.70	100.14	0.38	0.89
Atl-3T	3t-1-52	m	-	-	-	35.78	25.62	-	38.52	99.96	0.41	0.90
Atl-3T	3t-2-53	e	-	-	-	44.24	17.24	-	38.66	100.15	0.27	0.90
Atl-3T	3t-2-54	e	-	-	-	44.61	16.52	0.77	38.06	99.96	0.26	0.92
Atl-3T	3t-4-61	m	x	-	-	48.87	12.92	0.10	38.14	100.03	0.20	0.92
Atl-3T	3t-7-73	m	x	-	-	49.66	12.24	0.14	38.21	100.24	0.19	0.92
Atl-3T	3t-3-58	i	x	-	-	47.88	14.00	-	38.01	99.96	0.22	0.93

Atl-3T	3t-7-72	m	x	-	-	49.08	12.80	0.17	38.00	100.05	0.20	0.93
Atl-3T	3t-6-69	m	-	-	-	41.09	21.02	-	37.74	99.87	0.33	0.93
Atl-3U	3u-5-31	i	-	-	-	28.18	33.41	-	38.38	99.98	0.53	0.90
Atl-3U	3u-13-36	e	-	-	-	44.00	16.43	0.11	38.01	98.55	0.26	0.90
Atl-3U	3u-15-37	e	-	-	-	44.58	16.68	-	37.70	99.01	0.26	0.92
Atl-3U	3u-5-32	e	-	-	-	43.42	17.52	-	37.27	98.26	0.28	0.93
Atl-3V	3v-1-38	i	-	-	-	39.43	21.35	-	39.81	100.58	0.34	0.86
Atl-3V	3v-10-51	e	-	-	-	44.43	15.28	0.11	38.39	98.21	0.25	0.88
Atl-3V	3v-5-46	e	-	-	-	45.30	15.88	0.14	38.30	99.62	0.25	0.91
Atl-3V	3v-1-40	m	-	-	-	48.68	12.31	0.75	38.47	100.22	0.19	0.91
Atl-3V	3v-6-49	m	-	-	-	35.49	26.10	-	37.95	99.54	0.41	0.91
Atl-3V	3v-13-53	e	-	-	-	48.29	12.99	-	38.11	99.43	0.20	0.91
Atl-3V	3v-15-55	m	-	-	-	37.99	23.57	-	37.82	99.38	0.37	0.92
Atl-3V	3v-5-45	e	-	-	-	46.05	16.00	0.16	38.30	100.51	0.25	0.92
Atl-3V	3v-2-41	i	-	-	x	40.23	21.38	-	37.66	99.29	0.34	0.92
Atl-3V	3v-12-52	e	-	-	-	45.25	16.61	0.22	37.66	99.74	0.26	0.93
Atl-3V	3v-5-48	e	-	-	-	45.68	16.13	0.44	37.55	99.80	0.25	0.94
Atl-3V	3v-4-44	m	-	-	-	42.80	19.32	0.24	37.26	99.62	0.30	0.95
Atl-3V	3v-3-43	m	x	-	-	36.80	19.85	5.88	36.68	99.21	0.34	0.95

**Table S2.** Complete dataset of Middle Atlas pentlandite (pn) and iss major element composition and atomic Ni/(Ni + Fe) and metal/sulfur (M/S) ratios. Mineral formulas have been calculated for a number of 3 and 8 S units for iss and pentlandite, respectively.

Sample	EMP analysis #	phase	type	Fe [wt %]	Ni [wt %]	Cu [wt %]	S [wt %]	Total [wt %]	M/S <sub>at</sub>	Ni/(Ni+Fe) <sub>at</sub>	Fe	Ni	Cu	S
Atl-3A	3a-19-58	iss	e	38.81	2.34	22.37	34.56	98.07	1.01	0.05	1.93	0.11	0.98	3.00
Atl-3B	atl-3b-16	iss	e	38.60	3.91	20.88	34.45	97.84	1.01	0.09	1.93	0.19	0.92	3.00
Atl-3B	atl-3b-1	pn	m	35.90	30.01	1.11	32.66	99.67	1.15	0.44	5.05	4.02	0.14	8.00
Atl-3B	atl-3b-2	pn	m	35.52	30.28	0.90	32.82	99.52	1.14	0.45	4.97	4.03	0.11	8.00
Atl-3B	atl-3b-3	pn	m	35.79	30.99	0.45	32.72	99.96	1.15	0.45	5.02	4.14	0.06	8.00
Atl-3B	atl-3b-4	pn	m	39.54	26.86	0.51	33.26	100.18	1.13	0.39	5.46	3.53	0.06	8.00
Atl-3B	atl-3b-5	pn	m	35.90	30.26	1.33	32.89	100.38	1.15	0.45	5.01	4.02	0.16	8.00
Atl-3B	atl-3b-14	pn	i	35.37	31.12	0.12	32.28	98.90	1.16	0.46	5.03	4.21	0.02	8.00
Atl-3B	atl-3b-19	pn	e	31.77	34.87	0.21	32.79	99.64	1.14	0.51	4.45	4.65	0.03	8.00
Atl-3B	atl-3b-23	pn	i	36.08	27.41	0.87	33.18	97.53	1.09	0.42	4.99	3.61	0.11	8.00
Atl-3B	3b-5b-71	pn	m	33.91	32.78	0.52	33.48	100.69	1.12	0.48	4.65	4.28	0.06	8.00
Atl-3B	3b-5b-72	pn	m	33.36	32.42	1.14	33.50	100.41	1.12	0.48	4.57	4.23	0.14	8.00
Atl-3B	3b-5d-80	pn	i	34.32	31.02	0.65	31.97	97.96	1.16	0.46	4.93	4.24	0.08	8.00
Atl-3B	3b-13-102	pn	i	32.94	33.39	0.79	33.46	100.58	1.12	0.49	4.52	4.36	0.10	8.00
Atl-3B	3b-17a-107	pn	e	32.87	34.14	0.60	34.29	101.90	1.10	0.50	4.40	4.35	0.07	8.00
Atl-3B	3b-17b-108	pn	m	32.94	33.55	0.42	33.07	99.98	1.13	0.49	4.58	4.43	0.05	8.00
Atl-3B	3b-19-109	pn	m	29.36	37.63	0.08	33.35	100.42	1.12	0.55	4.04	4.93	0.01	8.00
Atl-3C	3c-4-10	pn	i	29.81	37.17	0.56	32.76	100.31	1.15	0.54	4.18	4.96	0.07	8.00
Atl-3V	3v-2-42	pn	i	30.53	35.62	0.93	32.75	99.83	1.14	0.53	4.28	4.75	0.11	8.00



