

Supplementary Information to:

Fossilization of Precambrian microfossils in the Volyn pegmatite, Ukraine

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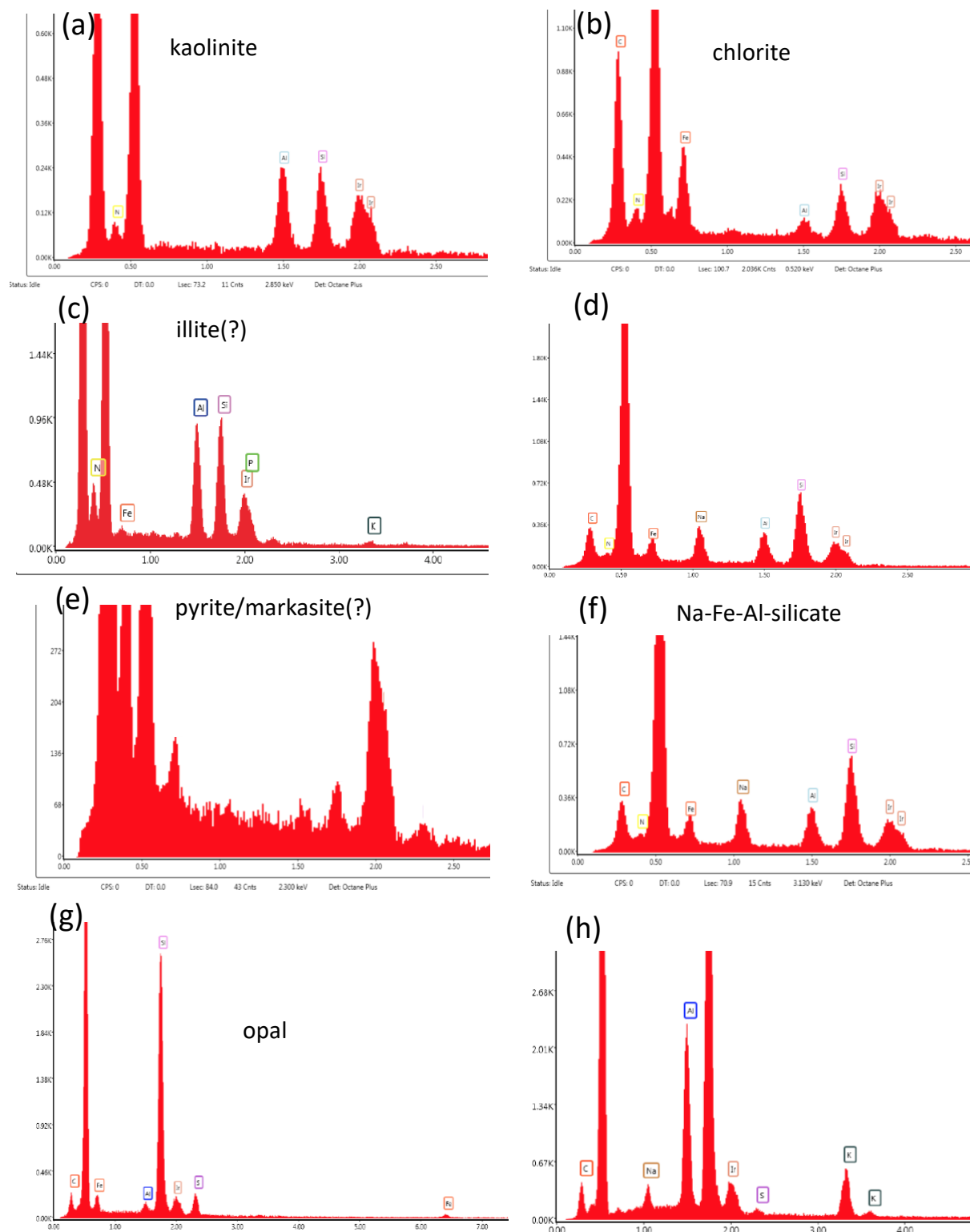


Fig. SI 1: EDS spectra of minerals and encrustations of fibrous kerite OM. All mineral identifications were made on the basis of the spectra and morphology, not verified by XRD. (a,b,c) information to Fig. 3a; (d) to Fig. 3b; (e) to Fig. 3c; (f) to Fig. 3e; (g) to Fig. 3f; (h) to Fig. 3h.

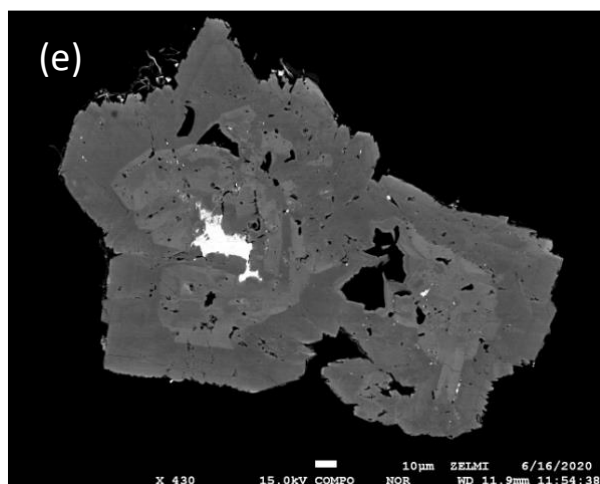
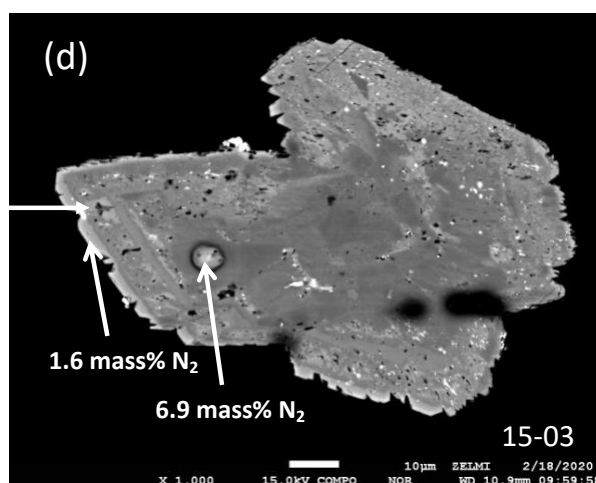
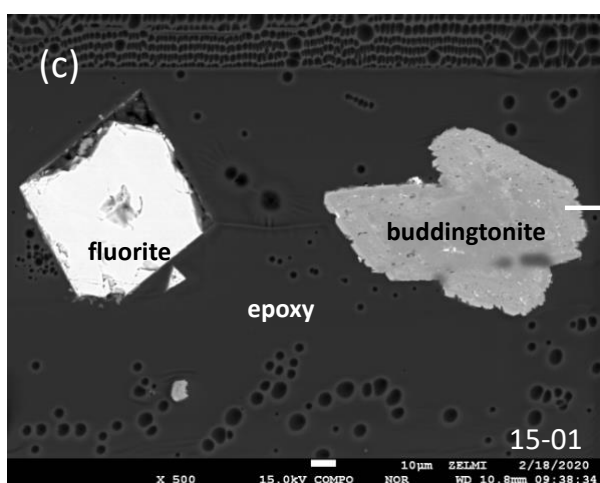
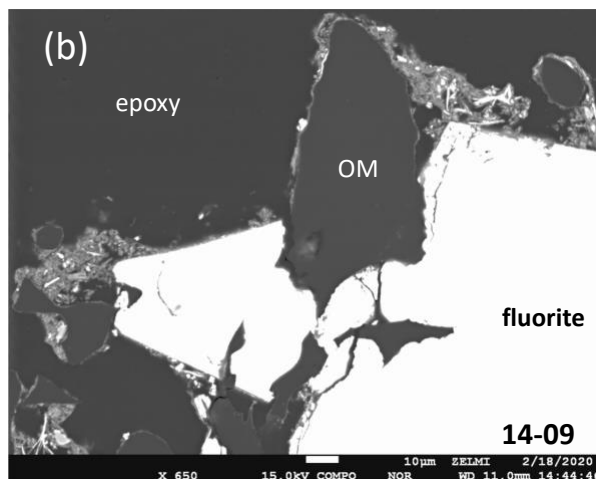
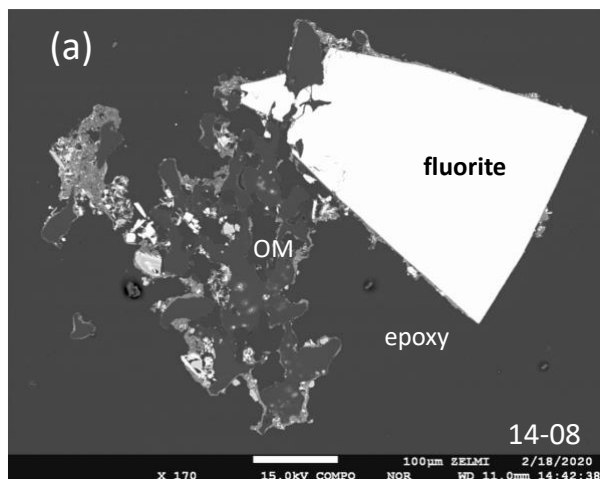


Figure SI 2: BSE images of grain mounts in epoxy, showing fluorite, closely intergrown with OM, and zoned buddingtonite

(a,b) kerite 14

(c,d) kerite 15; inclusions with high contrast are Fe-oxide

(e) kerite 11); outer zones with high contrast are rich in K, poor in NH_4 . Inner, irregular white grain is relict, igneous K-feldspar.

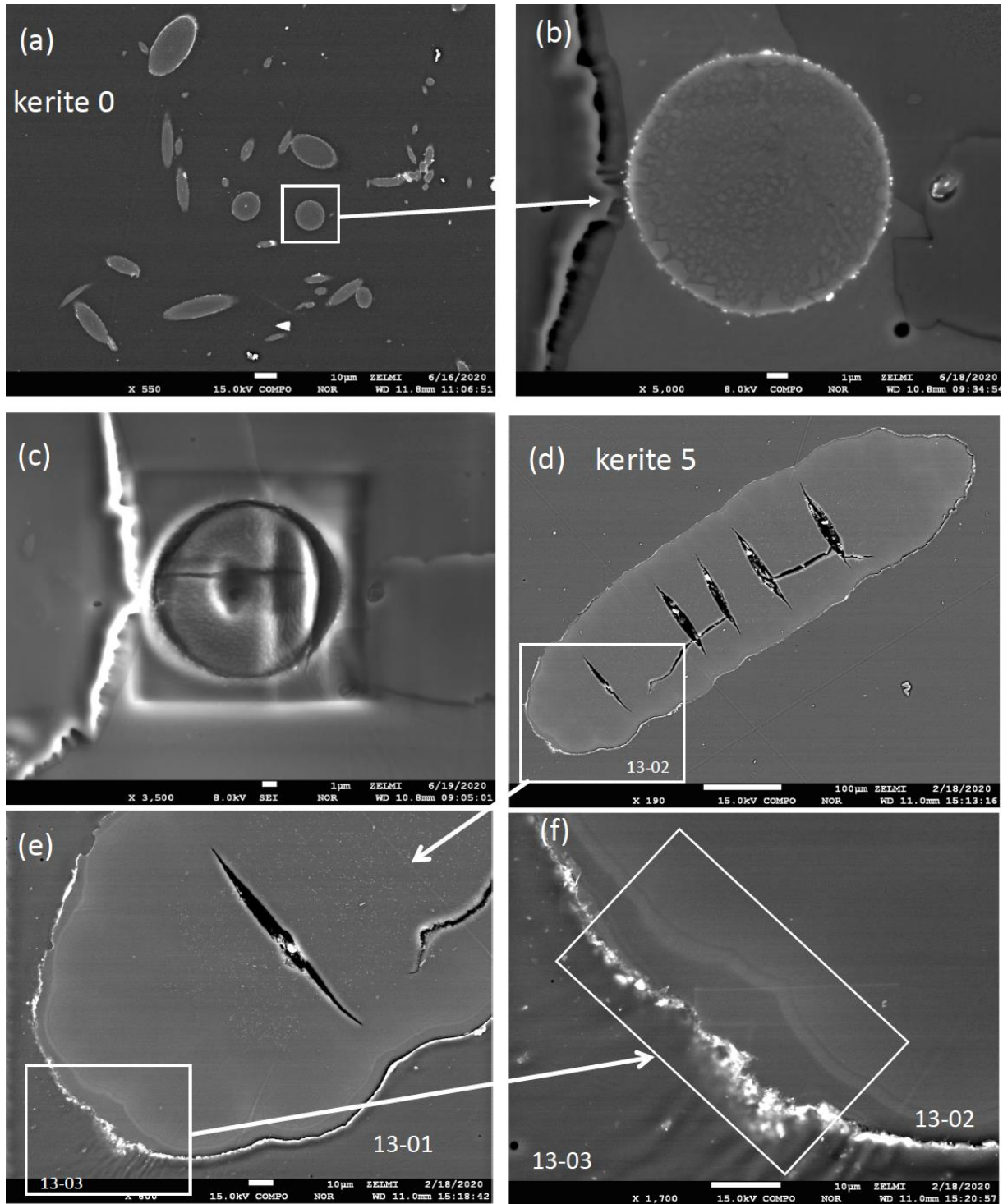


Fig. SI 3: BSE images of selected areas for mapping (a, b, e, f); (c) is combined SEM/BSE after mapping (a,b,c) are for mapping in Fig. SI 4.

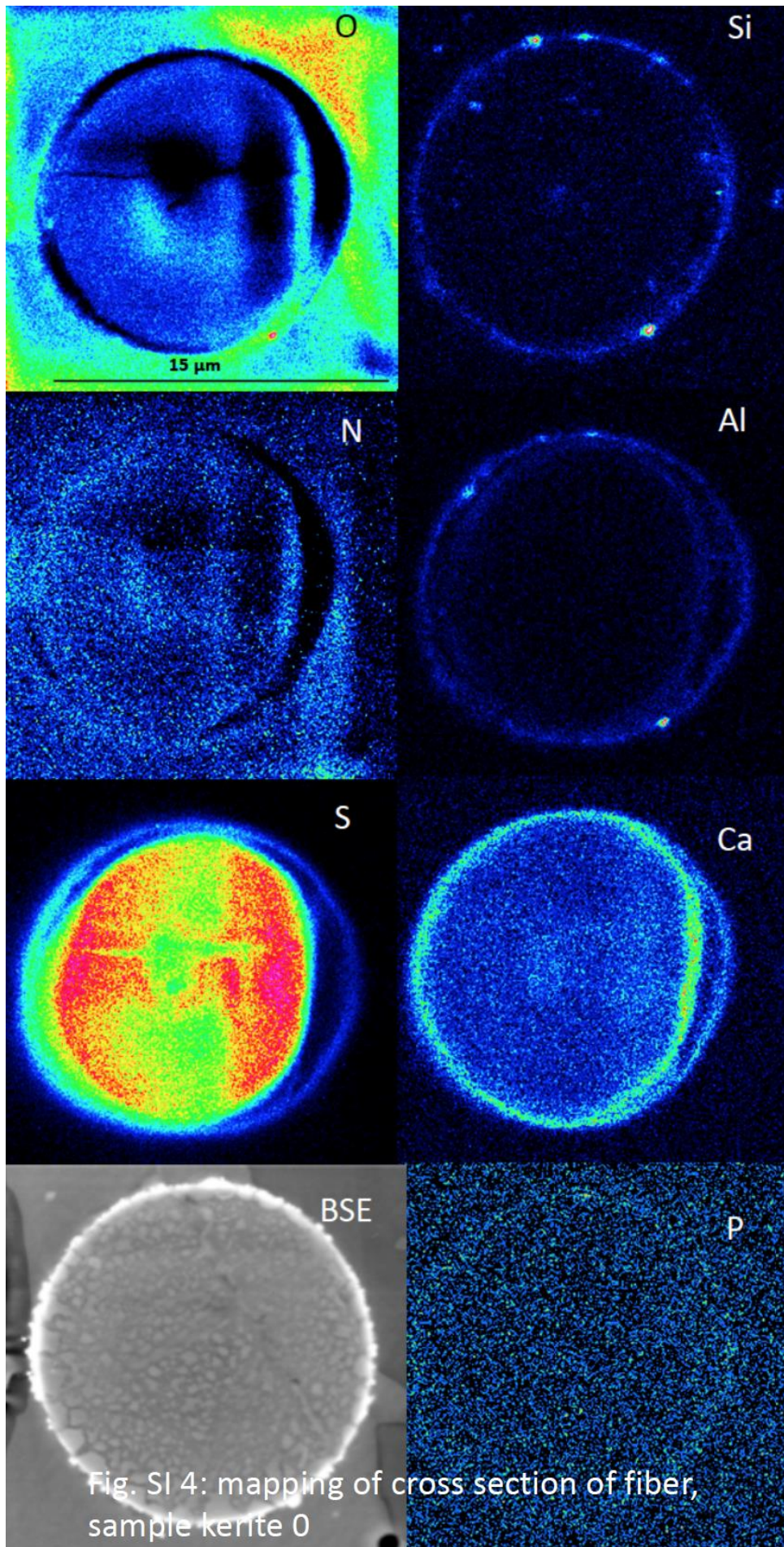


Fig. SI 4: mapping of cross section of fiber, sample kerite 0

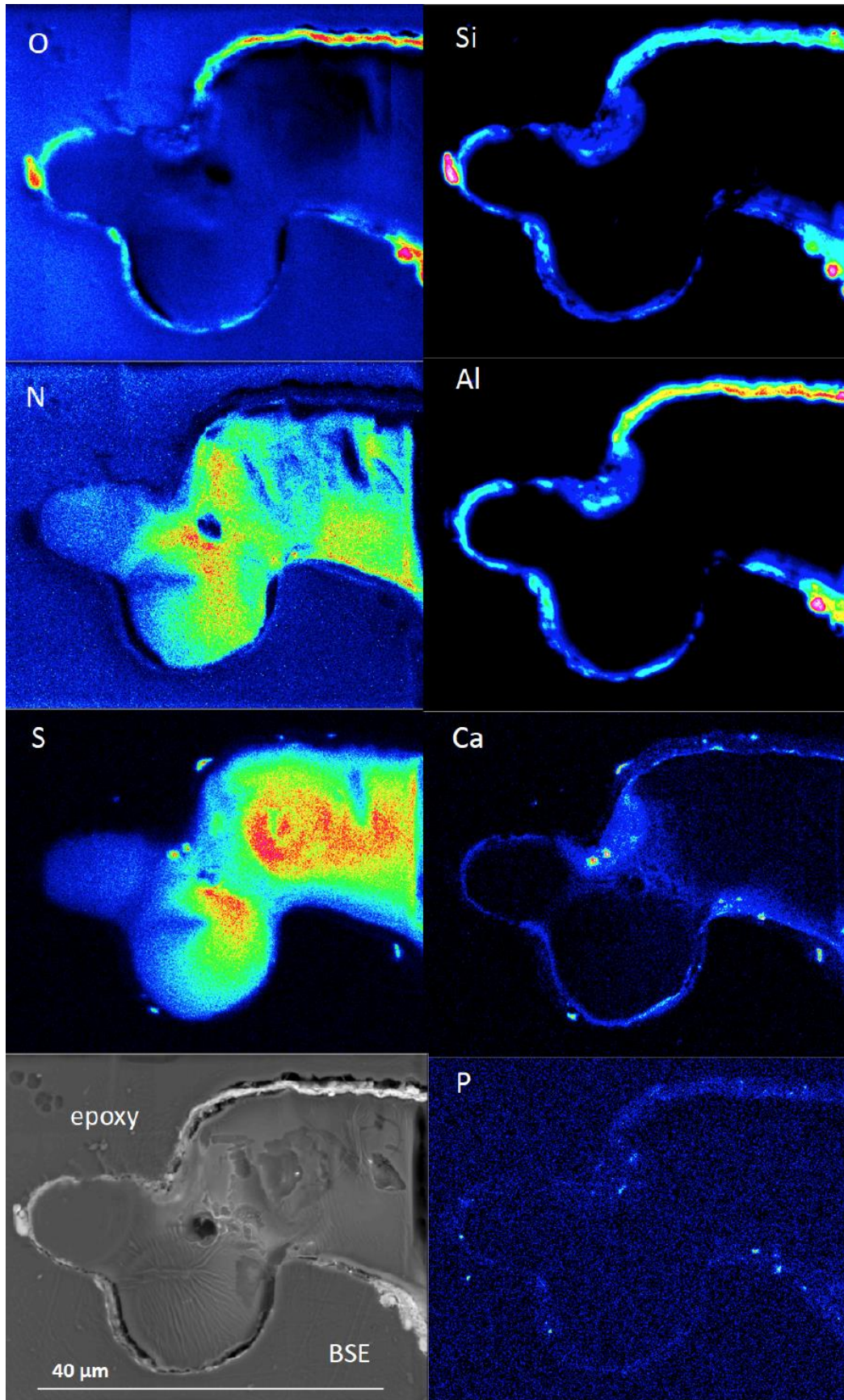


Fig. SI 5: Mapping of globular-flaky object of OM; note clearly visible phosphatization; sample kerite 11.

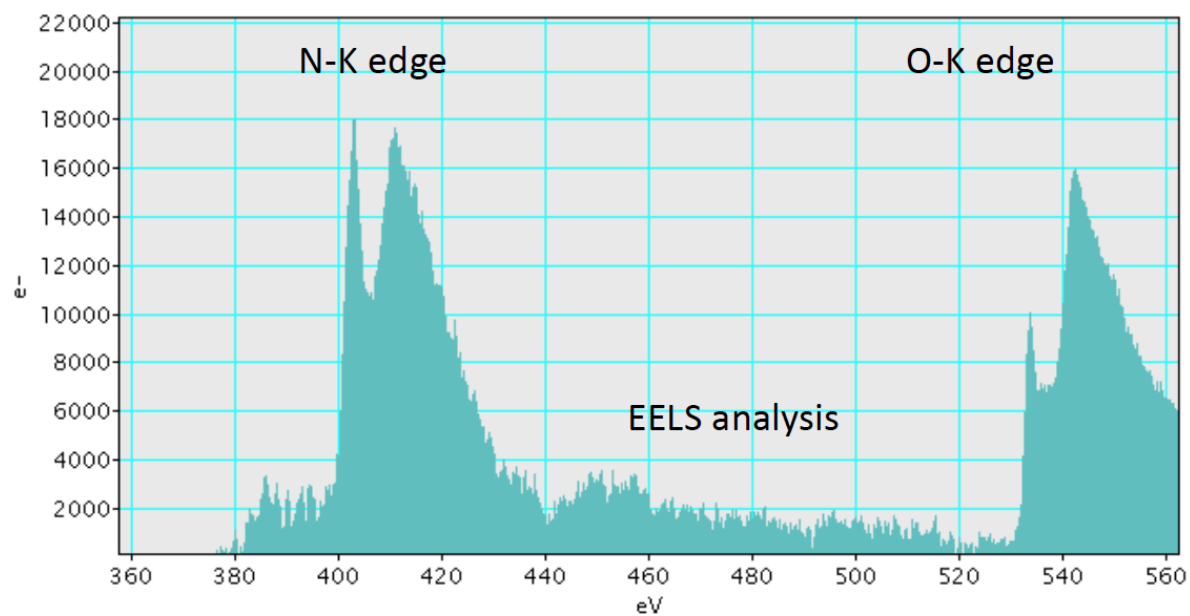
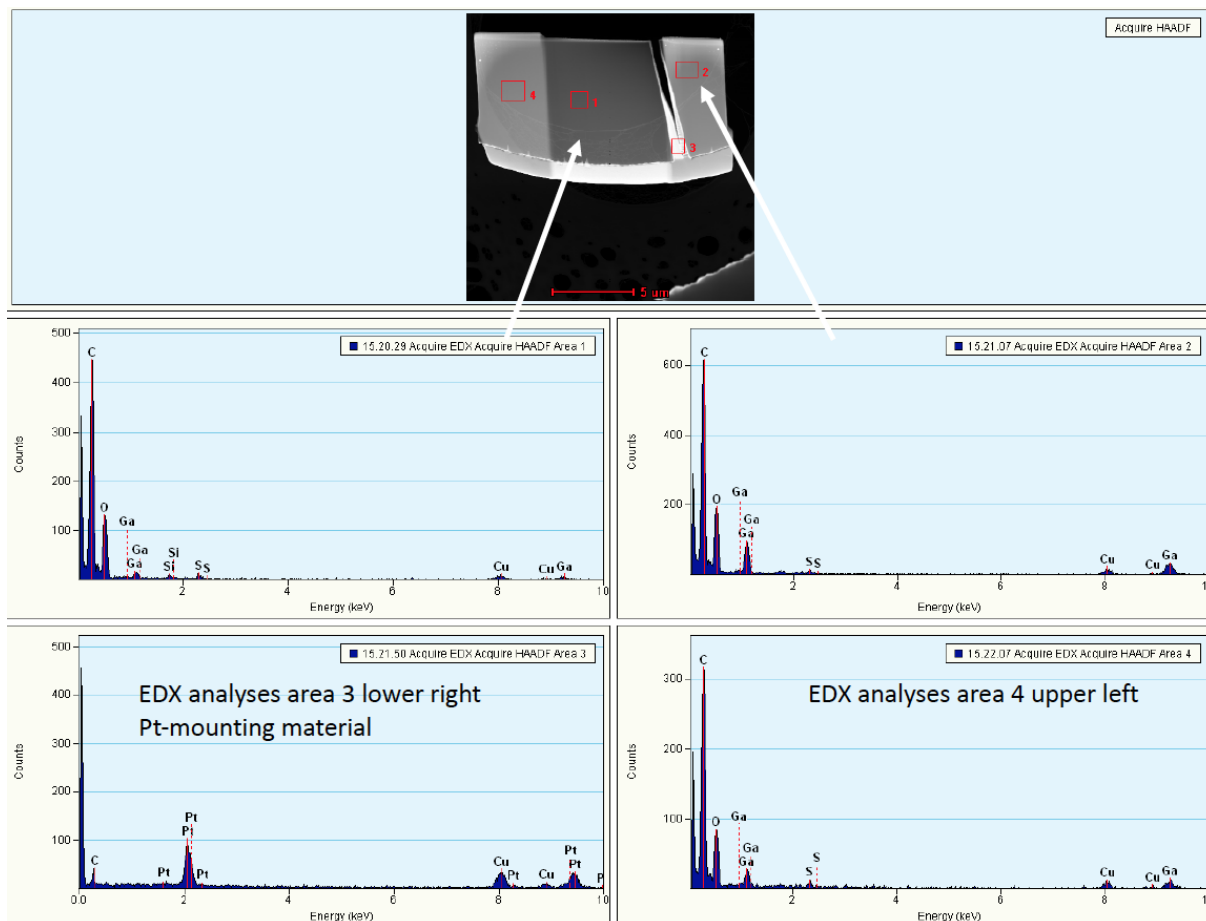
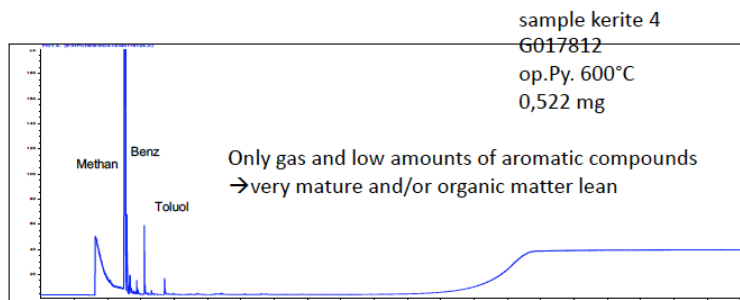
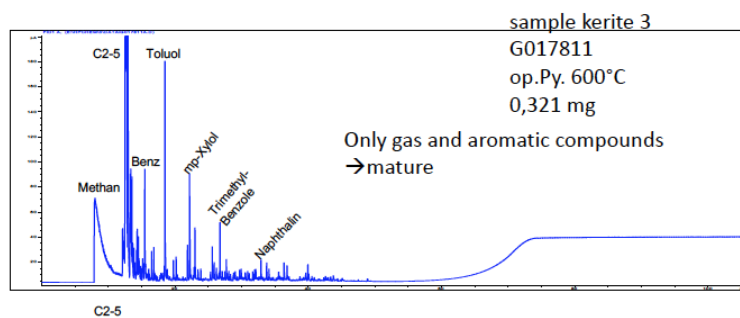
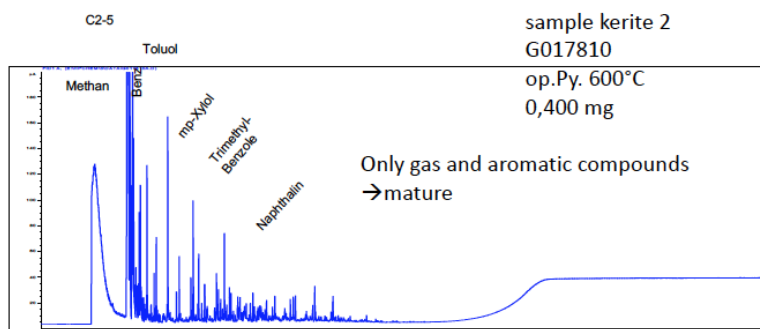
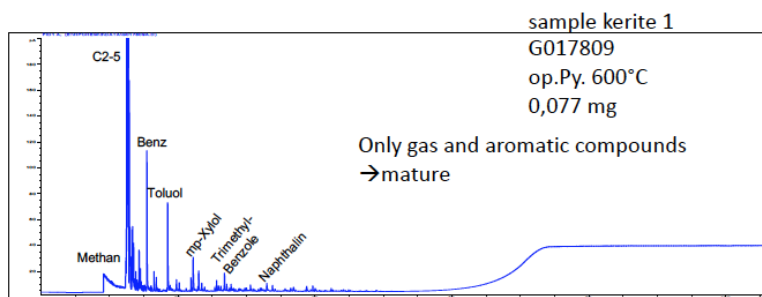


Fig. SI 6: Analytical TEM investigation, sample kerite 0; FIB foil #5047

Fig. SI 7, samples kerite 1-7, OM sample 9

Results of open system pyrolysis

kerite 1	G017809	mature
kerite 2	G017810	mature
kerite 3	G017811	mature
kerite 4	G017812	very mature/OM lean
kerite 5	G017813	mature
kerite 6	G017814	mature
kerite 7	G017815	mature
9 topaz with OM	G017816	very mature/OM lean



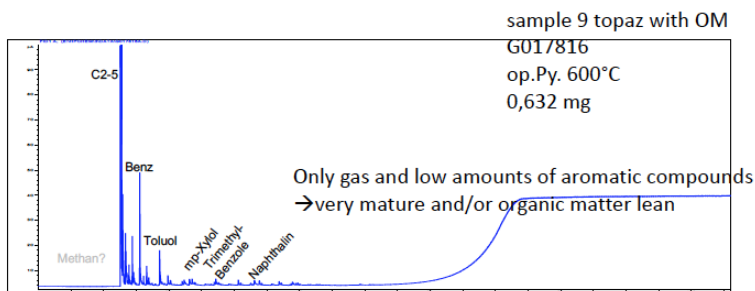
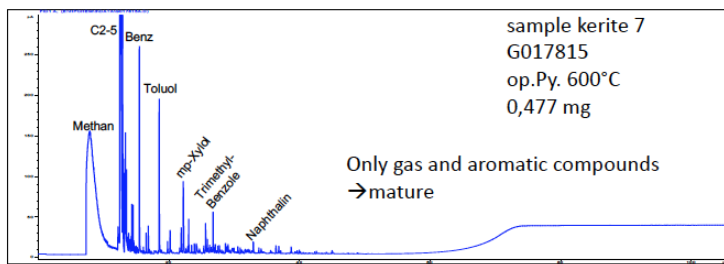
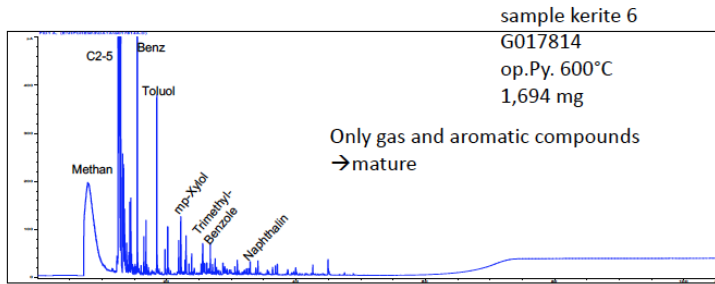
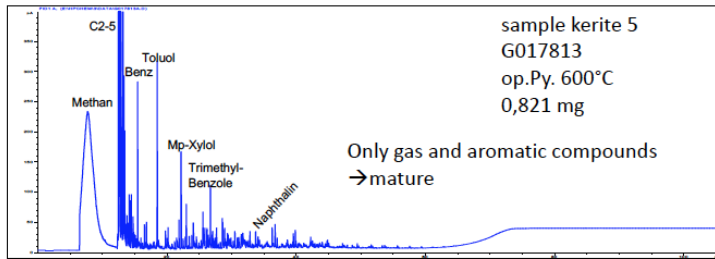


Table SI 1: Trace and major elements of black opal; samples BO31, 41 and 72 were used for U-Pb age determination

Element	Signal	BO31 µg/g	BO41 µg/g	BO72 µg/g
As	As75(HR)	0.04	0.17	0.05
Ba	Ba137(LR)	0.10	16.27	6.71
Be	Be9(MR)	0.07	5.82	8.24
Cd	Cd114(LR)	0.00	0.02	0.01
Co	Co59(MR)	0.02	0.74	0.47
Cr	Cr52(MR)	0.13	1.79	3.04
Cs	Cs133(MR)	0.01	0.79	0.02
Cu	Cu63(MR)	0.49	0.89	0.21
Ga	Ga69(MR)	0.02	0.84	0.29
Hf	Hf178(LR)	0.00	1.18	0.60
Li	Li7(LR)	5.13	79.13	0.24
Mo	Mo98(MR)	0.03	0.62	0.50
Nb	Nb93(MR)	0.16	0.72	0.77
Ni	Ni60(MR)	0.12	0.85	0.64
Pb	tot	0.92	2.06	0.08
Rb	Rb85(MR)	0.07	24.68	1.23
Sc	Sc45(MR)	0.01	2.94	2.50
Sn	Sn118(LR)	0.06	0.41	0.22
Sr	Sr86(MR)	0.07	4.26	4.30
Ta	Ta181(LR)	0.01	0.12	0.04
Th	Th232(LR)	0.00	9.88	0.66
U	U238(LR)	0.01	11.48	3.60
V	V51 (HR)	0.02	5.68	10.40
W	W182(HR)	0.02	0.54	0.13
Zn	Zn66(MR)	0.50	29.53	4.95
Zr	Zr90(MR)	0.11	72.17	73.01

Sample V-2008 EMPA

Analysis No.	1	2	3	4
Oxide	wt%	wt%	wt%	wt%
SiO2	95.84	96.8	95.32	95.43
TiO2	0.009	bd	0.013	0.003
Al2O3	0.75	0.61	0.71	1.01
Cr2O3	0.01	0.01	0.01	0.02
V2O3	bd	bd	bd	0.02
MgO	0.07	0.06	0.08	0.08
FeO	0.18	0.10	0.16	0.31
MnO	0.01	0.02	bd	bd
CaO	0.26	0.23	0.28	0.33
Na2O	0.03	0.02	0.02	0.15
K2O	0.06	0.05	0.05	0.10
Total	97.21	97.9	96.64	97.44

bd below detection

Table SI 2 U-Th isotope data

Material	g sample weight	g sample solution	g spike (U-Th)	235U/238U SD (%)	230Th/232Th SD (%)	238U (pmol)	2s (%)	235U (pmol)	2s (%)	232Th (pmol)	2s (%)	238U/232Th	238U/204Pb	1s (% est)	232Th/204Pb	1s (% est)
UKR1	0.00253	0.1006	0.03704	1.782	0.33	4.272	7.2	1.088	0.66	0.007888	0.66	0.09913	14.4	10.97	29425	5
UKR2	0.0009	0.1002	0.03029	4.104	0.41	6.485	3.73	0.3847	0.82	0.00279	0.82	0.03578	7.46	10.75	790	5
UKR3	0.00101	0.1	0.03088	3.496	0.64	6.304	2.78	0.4608	1.28	0.003342	1.28	0.03903	5.56	11.8	16765	5
UKR4	0.00038	0.0974	0.03053	6.226	0.43	1.335	2.61	0.2551	0.86	0.00185	0.86	0.3758	5.22	0.6787	235	5
UKR5	0.00043	0.0989	0.02973	3.782	0.68	1.621	2.12	0.4098	1.36	0.002972	1.36	0.2925	4.24	1.401	137	5
UKR6	0.00067	0.0987	0.03078	7.544	0.64	2.844	1.9	0.212	1.28	0.001538	1.28	0.15	3.8	1.413	130	5

Table SI 3 Opal U-Th-Pb isotope

Sample	weight (g)	ppm U	ppm Th	ppm Pb tot.	206Pb/204Pb	SD (%)	207Pb/204Pb	SD (%)	208Pb/204Pb	SD (%)	232Th/204Pb	SD (%)	238U/204Pb	SD (%)	
BO 1-1	black opal	0.00633	7.490	2.181	0.743	66.57	0.34	18.02	0.50	70.19	0.21	405.9	1.46	1394.68	3.82
BO 1-2	black opal	0.01036	19.40	11.812	1.537	62.08	0.42	17.93	0.79	66.51	0.40	1005	1.60	1654.77	6.15
BO 2-1	feldspar	0.00488	0.378	0.701	13.148	16.46	0.69	15.58	0.26	36.22	0.40	1.625	0.59	0.88	7.43
BO 2-2	black opal	0.00621	37.17	18.685	5.142	61.2	0.16	18.81	0.40	70.92	0.55	489.7	0.55	974.20	3.11
BO 3-1	black opal	0.02216	0.014	0.004	0.861	19.35	0.51	15.69	0.49	38.94	0.42	0.329	20.70	1.06	1.4
BO 3-2	black opal	0.00802	0.067	0.019	0.727	25.25	0.64	16.12	0.18	43.18	0.63	1.932	6.97	6.91	1.41
BO 4-1	black opal	0.01392	13.00	9.618	1.916	104.2	1.13	19.36	0.83	68.48	0.96	860.8	2.22	1163.12	4.92
BO 4-2	black opal	0.0269	0.065	0.042	0.376	18.85	0.37	15.75	0.54	38.64	0.49	7.229	13.40	11.35	0.62
BO 5-1	black opal	0.01289	7.527	0.300	0.145	44.89	0.57	16.69	0.70	41.74	1.02	191.1	1.83	4800.48	0.71
BO 5-2	black opal	0.01489	7.586	0.327	0.094	69.09	0.53	16.86	0.14	41.77	0.27	398.8	2.20	9241.76	3.46
BO 6-1	black opal	0.00894	5.672	0.641	0.116	152.3	5.81	21.11	5.46	53.02	5.25	1114	6.74	9866.42	2.39
BO 7-1	black opal	0.01646	3.786	0.617	0.076	302.2	4.61	20.7	5.49	54.99	3.65	2722	4.96	16700.50	1.88
BO 7-2	black opal	0.02329	4.400	0.659	0.079	167.1	2.20	18.29	3.13	45.86	2.79	1713	1.35	11450.34	4.69