

Supporting Informations

Combined Use of SEM-EDXS and FTIR Imaging coupled with PCA Analysis in the Study of Ancient Egyptian Papyri

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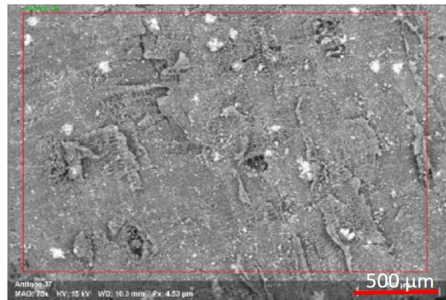
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SEM images and Energy-Dispersive X-ray spectra (EDX) page **S2-S10**

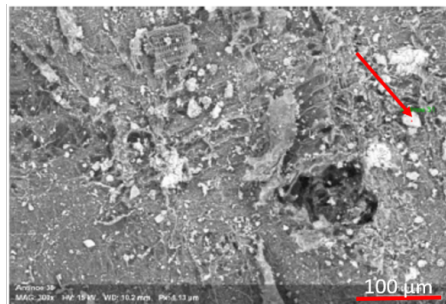
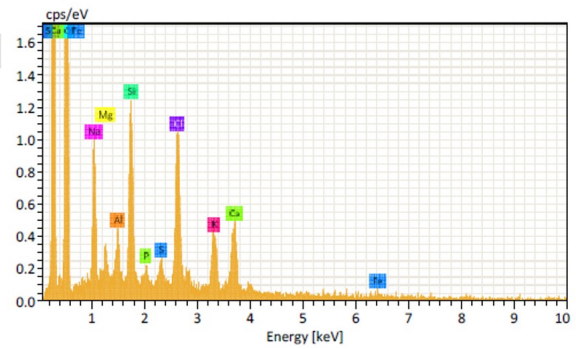
IR spectra of papyri samples page **S11-S14**

Antinopolis

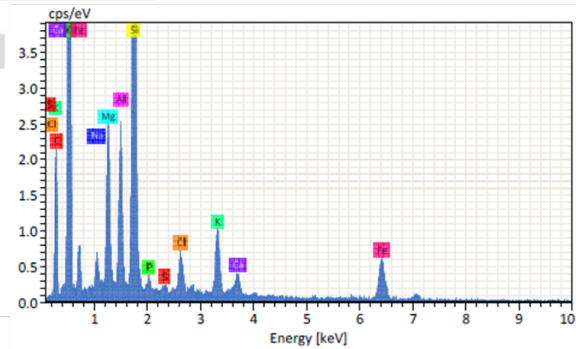
A

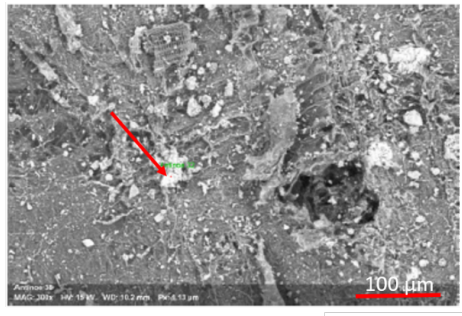


Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	6153	38.97	39.13	49.47	5.91
Oxygen	8	7908	45.14	45.32	43.03	6.57
Sodium	11	1491	2.38	2.39	1.58	0.20
Magnesium	12	345	0.42	0.43	0.27	0.06
Aluminium	13	542	0.60	0.61	0.34	0.07
Silicon	14	2554	2.78	2.79	1.51	0.16
Phosphorus	15	201	0.24	0.24	0.12	0.05
Sulfur	16	300	0.39	0.39	0.19	0.05
Chlorine	17	2733	4.29	4.30	1.84	0.20
Potassium	19	1131	1.58	1.58	0.61	0.10
Calcium	20	1395	2.55	2.56	0.97	0.13
Iron	26	46	0.26	0.26	0.07	0.07
Sum			99.60	100.00	100.00	



Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	2415	17.26	15.69	23.96	3.16
Oxygen	8	17019	53.09	48.25	55.32	6.96
Sodium	11	903	1.35	1.23	0.98	0.13
Magnesium	12	4130	4.49	4.08	3.08	0.29
Aluminium	13	4286	4.16	3.78	2.57	0.24
Silicon	14	15990	14.71	13.37	8.74	0.66
Phosphorus	15	187	0.19	0.17	0.10	0.04
Sulfur	16	202	0.20	0.19	0.11	0.04
Chlorine	17	1476	1.63	1.48	0.77	0.10
Potassium	19	2672	2.81	2.55	1.20	0.13
Calcium	20	938	1.29	1.17	0.54	0.09
Iron	26	2263	8.83	8.03	2.64	0.36
Sum			110.02	100.00	100.00	





Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	2257	22.81	26.19	43.72	4.23
Oxygen	8	2843	9.93	11.40	14.29	1.76
Sodium	11	35945	18.93	21.73	18.96	1.21
Magnesium	12	209	0.12	0.13	0.11	0.04
Silicon	14	953	0.50	0.57	0.41	0.05
Sulfur	16	416	0.27	0.31	0.19	0.04
Chlorine	17	42385	32.86	37.72	21.34	1.13
Potassium	19	547	0.70	0.81	0.41	0.07
Calcium	20	646	0.99	1.14	0.57	0.08
		Sum	87.10	100.00	100.00	

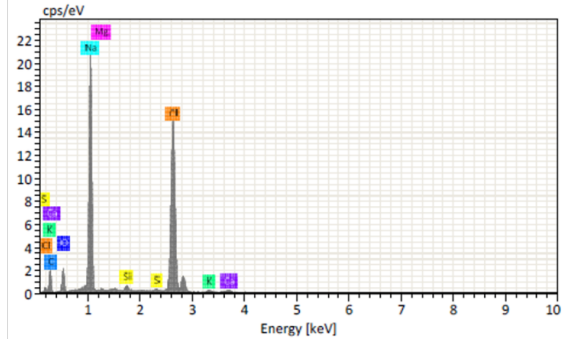
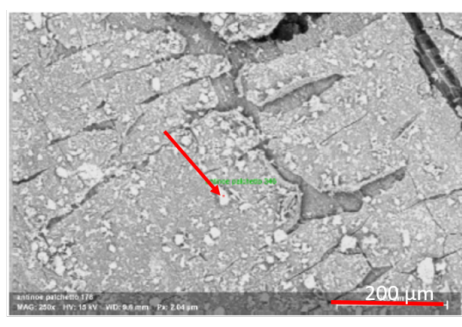
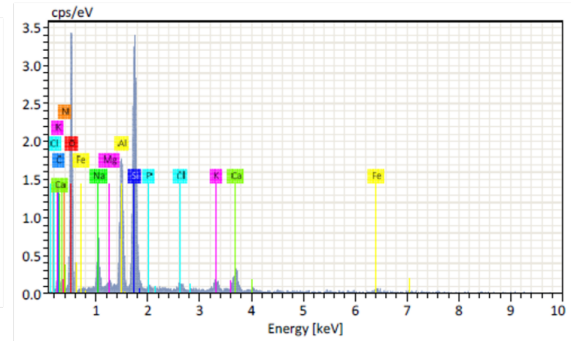


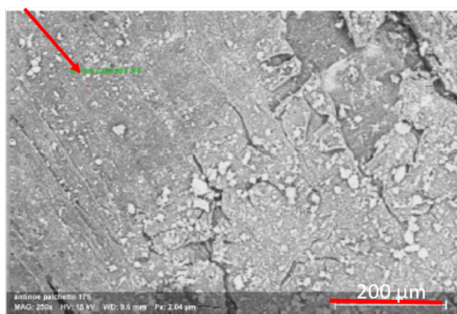
Figure S1. SEM-EDXS analysis of A papyrus

A'

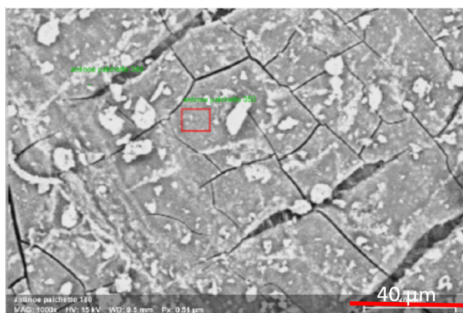
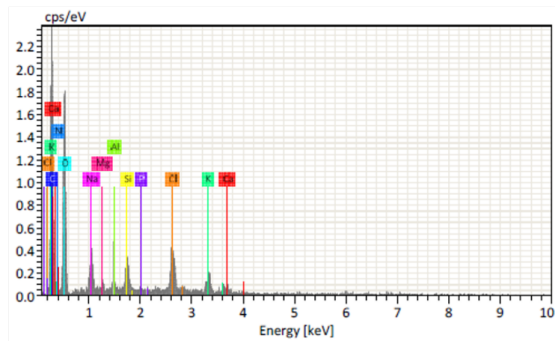


Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	693	13.84	15.48	23.36	3.51
Nitrogen	7	42	0.97	1.09	1.41	0.72
Oxygen	8	4883	41.14	46.04	52.16	6.49
Sodium	11	964	2.88	3.22	2.54	0.25
Magnesium	12	126	0.29	0.32	0.24	0.06
Aluminium	13	3418	6.98	7.81	5.25	0.39
Silicon	14	7546	15.84	17.72	11.44	0.73
Phosphorus	15	2	0.00	0.00	0.00	0.00
Chlorine	17	227	0.64	0.72	0.37	0.08
Potassium	19	404	1.46	1.63	0.76	0.12
Calcium	20	880	3.79	4.25	1.92	0.21
Iron	26	132	1.53	1.71	0.56	0.18
		Sum	89.38	100.00	100.00	





Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	2667	35.01	43.80	53.49	6.24
Nitrogen	7	16	0.62	0.78	0.82	0.71
Oxygen	8	2608	34.59	43.29	39.68	6.19
Sodium	11	559	2.66	3.33	2.12	0.26
Magnesium	12	90	0.31	0.39	0.24	0.07
Aluminium	13	99	0.29	0.36	0.20	0.06
Silicon	14	627	1.63	2.04	1.07	0.13
Phosphorus	15	45	0.12	0.15	0.07	0.04
Chlorine	17	1052	2.62	3.28	1.35	0.16
Potassium	19	468	1.51	1.90	0.71	0.12
Calcium	20	129	0.56	0.70	0.26	0.08
Sum		79.92	100.00	100.00	100.00	



Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	3097	36.00	36.64	46.24	6.21
Nitrogen	7	48	1.52	1.54	1.67	1.05
Oxygen	8	4292	47.49	48.33	45.80	7.67
Sodium	11	914	2.69	2.74	1.81	0.24
Magnesium	12	212	0.46	0.47	0.29	0.07
Aluminium	13	239	0.45	0.46	0.26	0.07
Silicon	14	389	0.68	0.69	0.37	0.08
Phosphorus	15	362	0.66	0.67	0.33	0.07
Chlorine	17	808	2.90	2.95	1.26	0.18
Potassium	19	631	2.51	2.56	0.99	0.16
Calcium	20	336	1.61	1.63	0.62	0.13
Iron	26	100	1.29	1.31	0.36	0.17
Sum		98.26	100.00	100.00	100.00	

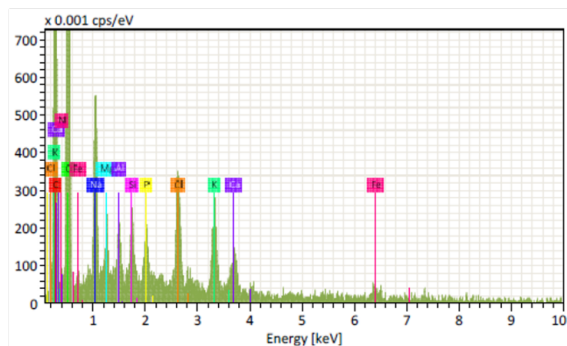
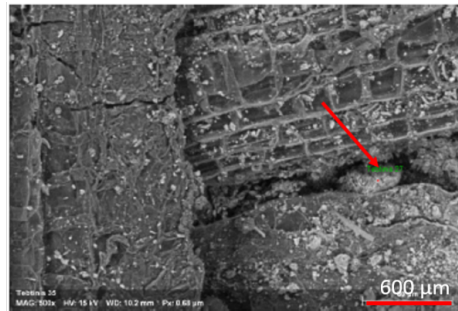


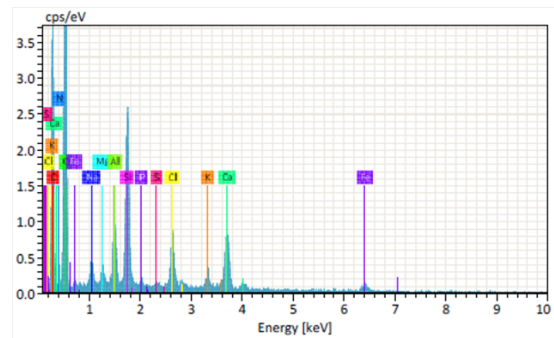
Figure S2. SEM-EDXS analysis of A' papyrus

Tebtynis

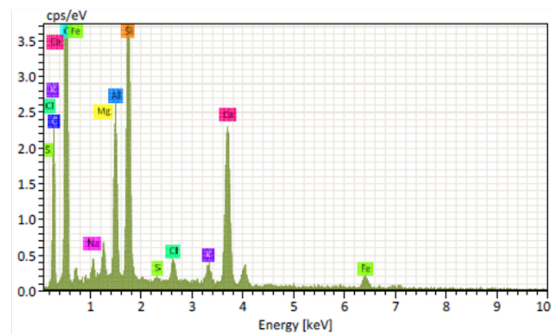
B



Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	4541	31.11	29.30	38.94	4.98
Nitrogen	7	59	0.85	0.81	0.92	0.55
Oxygen	8	10536	53.89	50.75	50.63	7.51
Sodium	11	594	1.15	1.08	0.75	0.13
Magnesium	12	457	0.64	0.60	0.40	0.08
Aluminium	13	1991	2.42	2.27	1.35	0.16
Silicon	14	5405	6.22	5.86	3.33	0.31
Phosphorus	15	97	0.12	0.11	0.06	0.04
Sulfur	16	96	0.11	0.10	0.05	0.04
Chlorine	17	1769	2.19	2.06	0.93	0.12
Potassium	19	552	0.90	0.85	0.35	0.08
Calcium	20	2599	5.08	4.79	1.91	0.22
Iron	26	286	1.51	1.42	0.41	0.13
Sum			106.19	100.00	100.00	



Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	2661	16.50	15.47	23.01	2.95
Oxygen	8	14817	58.16	54.51	60.89	7.75
Sodium	11	422	0.62	0.59	0.46	0.08
Magnesium	12	846	0.90	0.84	0.62	0.09
Aluminium	13	4716	4.30	4.03	2.67	0.24
Silicon	14	10304	8.98	8.42	5.36	0.42
Sulfur	16	172	0.18	0.17	0.09	0.04
Chlorine	17	855	0.96	0.90	0.45	0.08
Potassium	19	715	0.96	0.90	0.41	0.08
Calcium	20	7644	12.76	11.96	5.33	0.44
Iron	26	556	2.36	2.21	0.71	0.16
Sum			106.69	100.00	100.00	





Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	2042	17.30	19.72	29.34	3.29
Oxygen	8	10206	39.62	45.17	50.45	5.56
Sodium	11	285	0.43	0.49	0.38	0.07
Magnesium	12	448	0.49	0.56	0.41	0.07
Aluminium	13	7461	7.15	8.15	5.40	0.38
Silicon	14	13786	13.28	15.14	9.63	0.60
Phosphorus	15	14	0.02	0.02	0.01	0.00
Sulfur	16	80	0.09	0.10	0.06	0.04
Chlorine	17	959	1.13	1.29	0.65	0.08
Potassium	19	955	1.47	1.68	0.77	0.10
Calcium	20	1791	3.15	3.59	1.60	0.15
Iron	26	769	3.60	4.11	1.31	0.21
Sum		87.73		100.00	100.00	

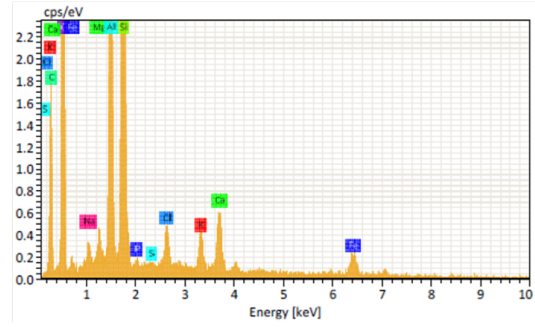
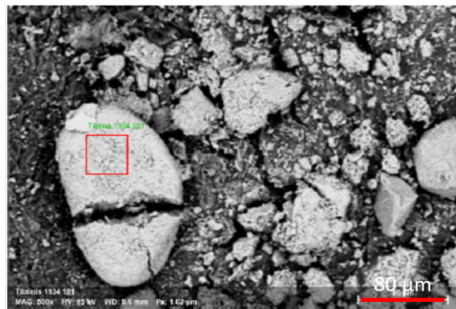
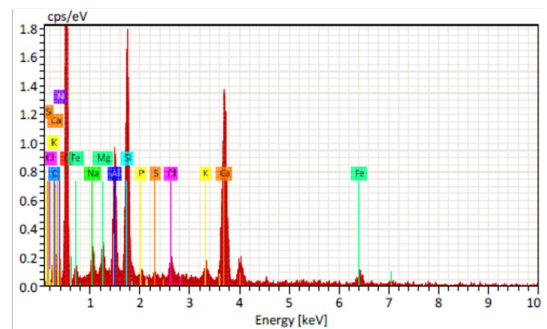


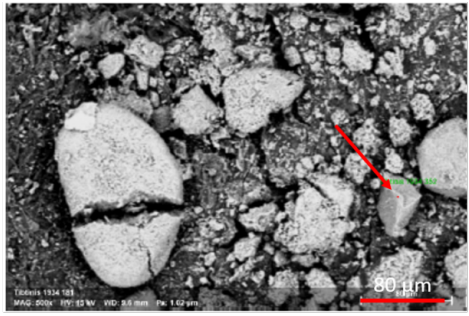
Figure S3. SEM-EDXS analysis of B papyrus

B'

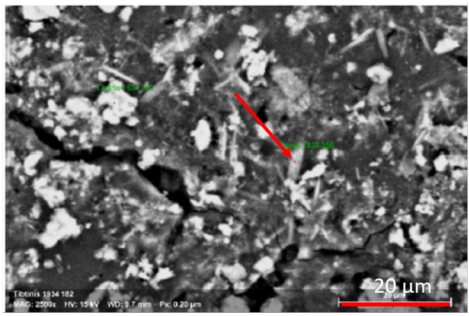
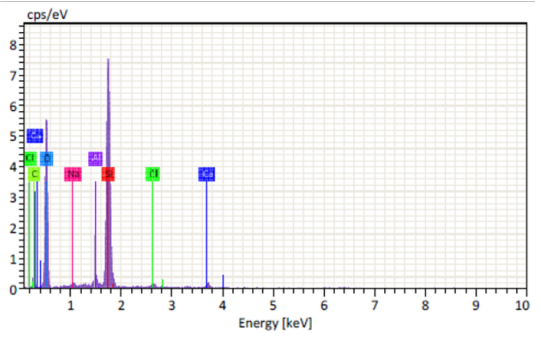


Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	844	12.93	12.54	19.58	3.10
Nitrogen	7	51	1.45	1.40	1.88	0.98
Oxygen	8	4781	52.56	50.95	59.73	8.32
Sodium	11	247	0.85	0.82	0.67	0.12
Magnesium	12	327	0.80	0.77	0.60	0.10
Aluminium	13	1697	3.53	3.42	2.38	0.23
Silicon	14	3684	7.22	7.00	4.67	0.37
Phosphorus	15	44	0.09	0.09	0.05	0.04
Sulfur	16	93	0.19	0.19	0.11	0.05
Chlorine	17	360	0.81	0.79	0.42	0.08
Potassium	19	250	0.91	0.88	0.42	0.09
Calcium	20	4290	18.61	18.04	8.45	0.67
Iron	26	283	3.21	3.11	1.04	0.26
Sum		103.16		100.00	100.00	





Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	538	10.57	11.27	16.96	2.90
Oxygen	8	8266	50.69	54.07	61.06	7.32
Sodium	11	140	0.34	0.37	0.29	0.07
Aluminium	13	561	0.91	0.97	0.65	0.09
Silicon	14	16893	29.18	31.13	20.02	1.28
Chlorine	17	243	0.57	0.61	0.31	0.07
Calcium	20	401	1.49	1.59	0.72	0.12
		Sum	93.76	100.00	100.00	



Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	1931	30.78	29.89	40.24	5.90
Oxygen	8	4316	49.24	47.81	48.32	7.95
Sodium	11	775	2.61	2.54	1.79	0.24
Magnesium	12	104	0.27	0.26	0.18	0.06
Aluminium	13	361	0.84	0.82	0.49	0.09
Silicon	14	2279	5.23	5.08	2.93	0.29
Phosphorus	15	73	0.19	0.18	0.10	0.05
Sulfur	16	1462	4.09	3.97	2.00	0.22
Chlorine	17	839	2.88	2.80	1.28	0.18
Potassium	19	138	0.40	0.38	0.16	0.06
Calcium	20	1735	6.45	6.27	2.53	0.29
		Sum	102.98	100.00	100.00	

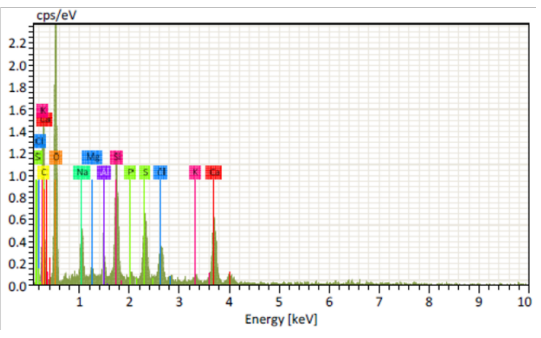
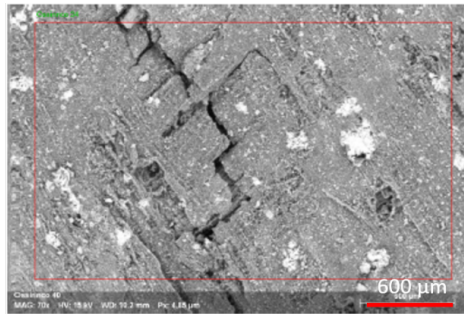


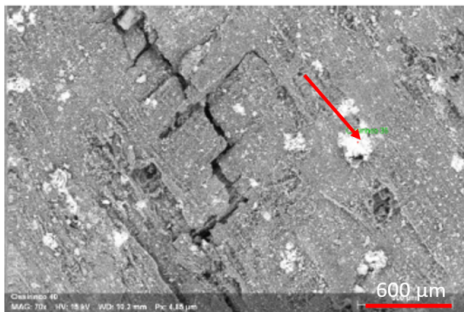
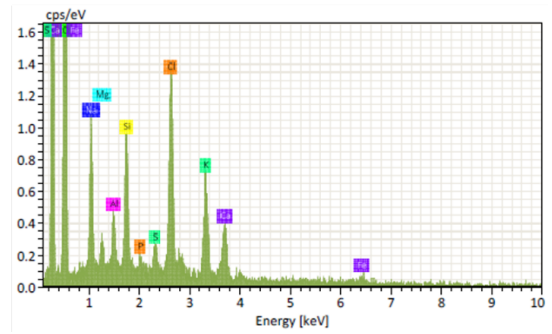
Figure S4. SEM-EDXS analysis of B' papyrus

Oxyrhynchus

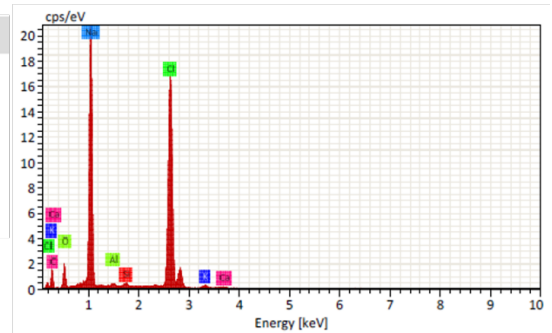
C

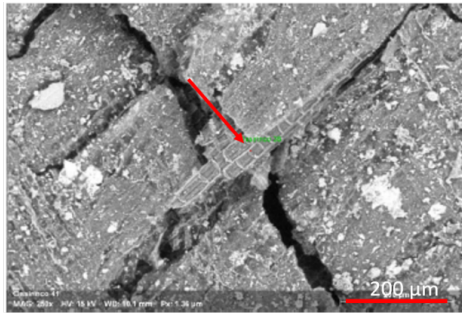


Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	5849	40.21	37.53	48.03	6.15
Oxygen	8	8180	49.01	45.75	43.95	7.09
Sodium	11	1582	2.85	2.66	1.78	0.24
Magnesium	12	337	0.46	0.43	0.27	0.07
Aluminium	13	615	0.74	0.69	0.39	0.08
Silicon	14	1966	2.26	2.11	1.15	0.14
Phosphorus	15	151	0.18	0.17	0.09	0.04
Sulfur	16	350	0.45	0.42	0.20	0.06
Chlorine	17	3409	5.07	4.73	2.05	0.23
Potassium	19	1942	3.19	2.98	1.17	0.16
Calcium	20	1022	2.10	1.96	0.75	0.12
Iron	26	119	0.60	0.56	0.15	0.09
		Sum	107.13	100.00	100.00	



Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	1697	21.32	22.28	39.06	4.23
Oxygen	8	2413	9.59	10.03	13.20	1.77
Sodium	11	36902	22.34	23.35	21.39	1.42
Aluminium	13	263	0.20	0.21	0.16	0.04
Silicon	14	551	0.39	0.41	0.31	0.05
Chlorine	17	47554	40.57	42.41	25.19	1.39
Potassium	19	611	0.80	0.84	0.45	0.07
Calcium	20	290	0.46	0.48	0.25	0.06
		Sum	95.67	100.00	100.00	





Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	7169	44.78	44.84	55.48	6.62
Oxygen	8	6466	40.87	40.92	38.02	6.15
Sodium	11	1306	2.16	2.16	1.40	0.19
Magnesium	12	322	0.40	0.40	0.24	0.06
Aluminium	13	293	0.32	0.32	0.17	0.05
Silicon	14	957	0.98	0.98	0.52	0.08
Sulfur	16	193	0.23	0.23	0.11	0.05
Chlorine	17	3836	5.46	5.47	2.29	0.24
Potassium	19	2017	3.22	3.22	1.23	0.16
Calcium	20	766	1.46	1.46	0.54	0.10
Sum		99.87	100.00	100.00	100.00	

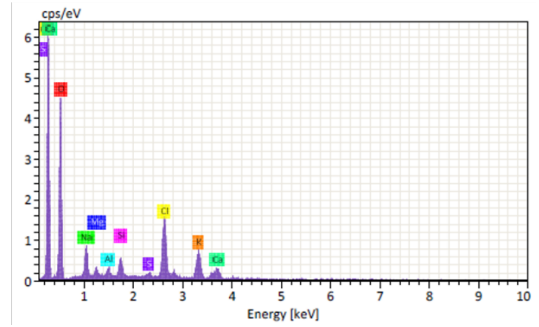
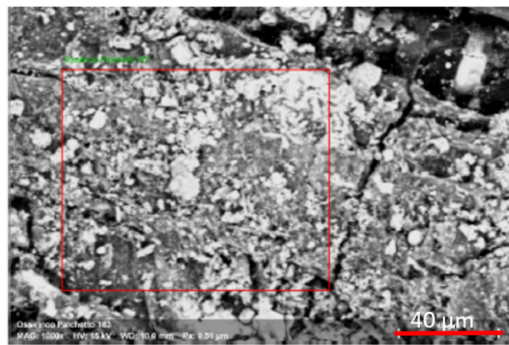
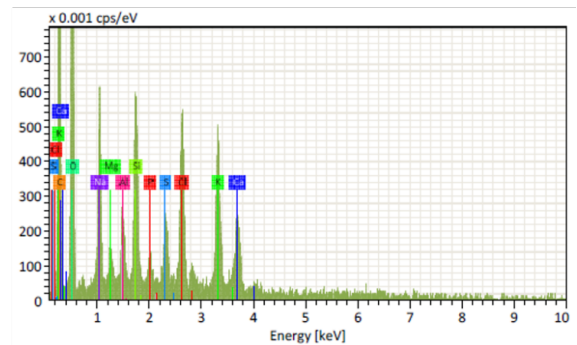


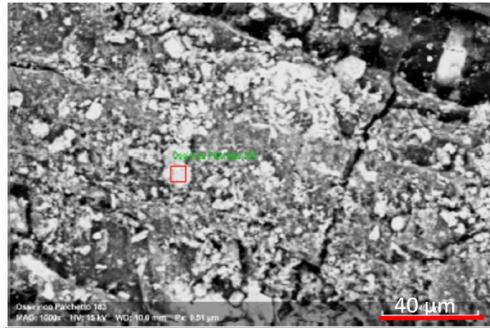
Figure S5. SEM-EDXS analysis of C papyrus

C'

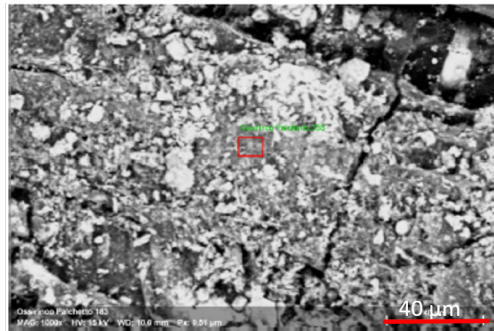
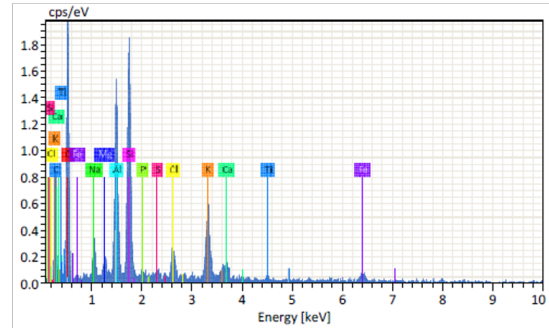


Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	1848	35.90	36.42	48.36	6.96
Oxygen	8	2353	38.69	39.25	39.13	7.08
Sodium	11	835	3.83	3.89	2.70	0.34
Magnesium	12	166	0.60	0.61	0.40	0.09
Aluminium	13	408	1.33	1.35	0.80	0.13
Silicon	14	1242	3.98	4.04	2.29	0.25
Phosphorus	15	136	0.48	0.49	0.25	0.08
Sulfur	16	469	1.79	1.81	0.90	0.14
Chlorine	17	1274	5.85	5.93	2.67	0.30
Potassium	19	1237	3.51	3.56	1.45	0.18
Calcium	20	704	2.61	2.65	1.05	0.16
Sum		98.57	100.00	100.00	100.00	





Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	998	21.96	24.21	35.52	5.00
Oxygen	8	2921	36.73	40.50	44.60	6.42
Sodium	11	412	1.65	1.82	1.39	0.18
Magnesium	12	199	0.59	0.65	0.47	0.09
Aluminium	13	2635	6.85	7.56	4.93	0.40
Silicon	14	3762	9.79	10.79	6.77	0.49
Phosphorus	15	91	0.26	0.29	0.16	0.06
Sulfur	16	130	0.37	0.41	0.22	0.06
Chlorine	17	549	1.73	1.91	0.95	0.13
Potassium	19	1481	6.59	7.26	3.27	0.31
Calcium	20	313	1.66	1.83	0.80	0.14
Titanium	22	58	0.40	0.44	0.16	0.08
Iron	26	195	2.12	2.34	0.74	0.20
Sum		90.71	100.00	100.00	100.00	



Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)
Carbon	6	1952	48.56	42.72	56.35	9.28
Oxygen	8	1974	33.94	29.86	29.57	6.47
Sodium	11	1600	7.64	6.72	4.63	0.59
Magnesium	12	138	0.51	0.45	0.29	0.09
Aluminium	13	271	0.85	0.75	0.44	0.10
Silicon	14	845	2.39	2.10	1.19	0.17
Phosphorus	15	117	0.34	0.30	0.15	0.06
Sulfur	16	161	0.45	0.40	0.20	0.07
Chlorine	17	4371	13.46	11.84	5.29	0.54
Potassium	19	838	3.10	2.73	1.11	0.18
Calcium	20	401	1.79	1.57	0.62	0.14
Iron	26	57	0.63	0.56	0.16	0.12
Sum		113.67	100.00	100.00	100.00	

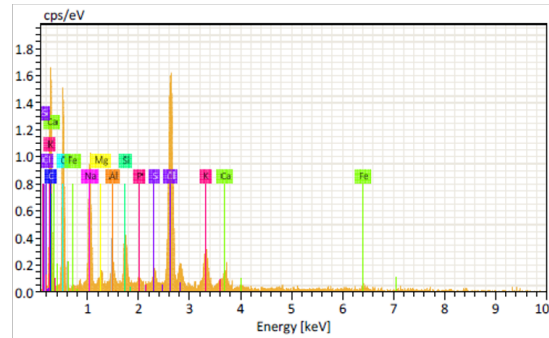


Figure S6. SEM-EDXS analysis of C' papyrus

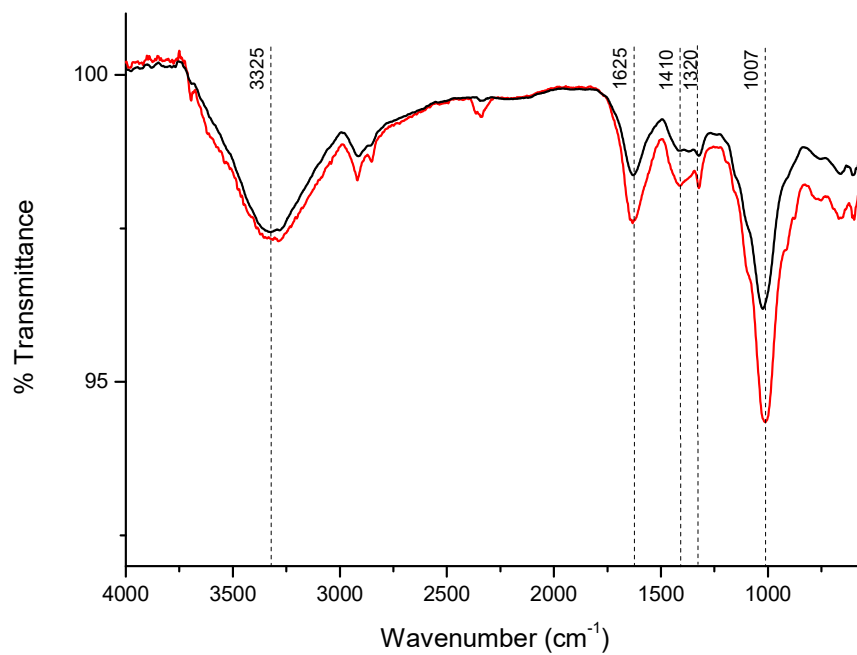


Figure S7. A. Antioe with ink (red) and without ink (black)

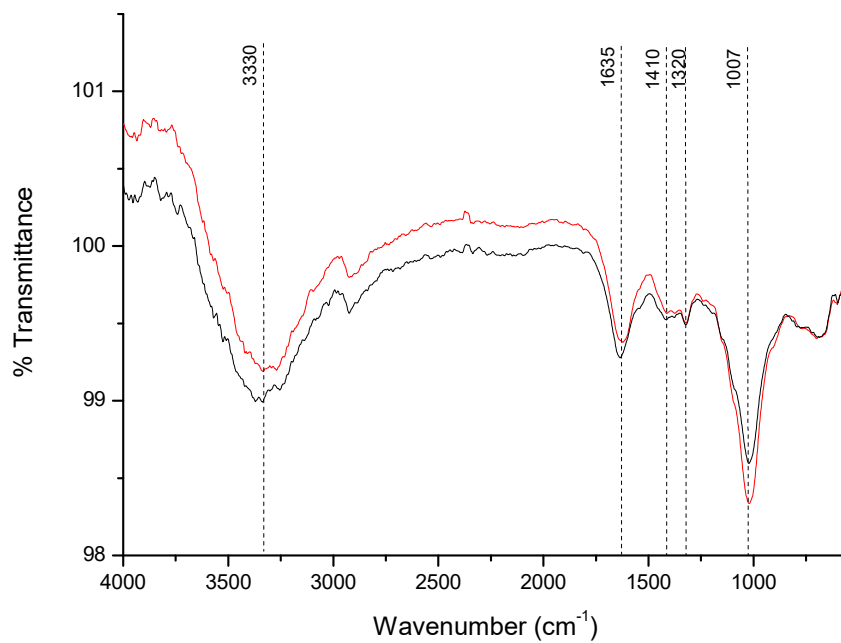


Figure S8. A' Antioe with ink (red) and without ink (black)

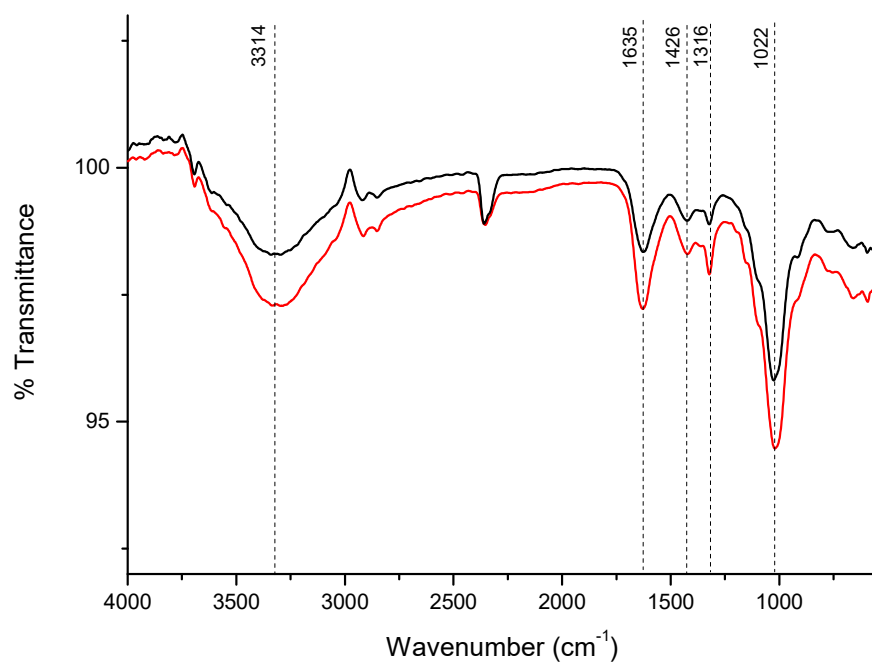


Figure S9. B Tebtynis with ink (red) and without ink (black)

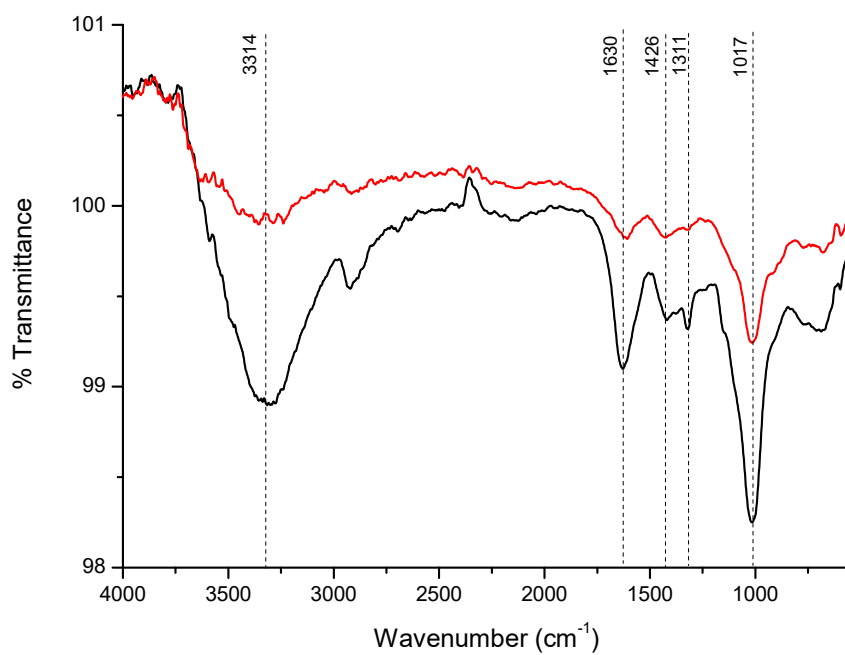


Figure S10. B' Tebtynis with ink (red) and without ink (black)

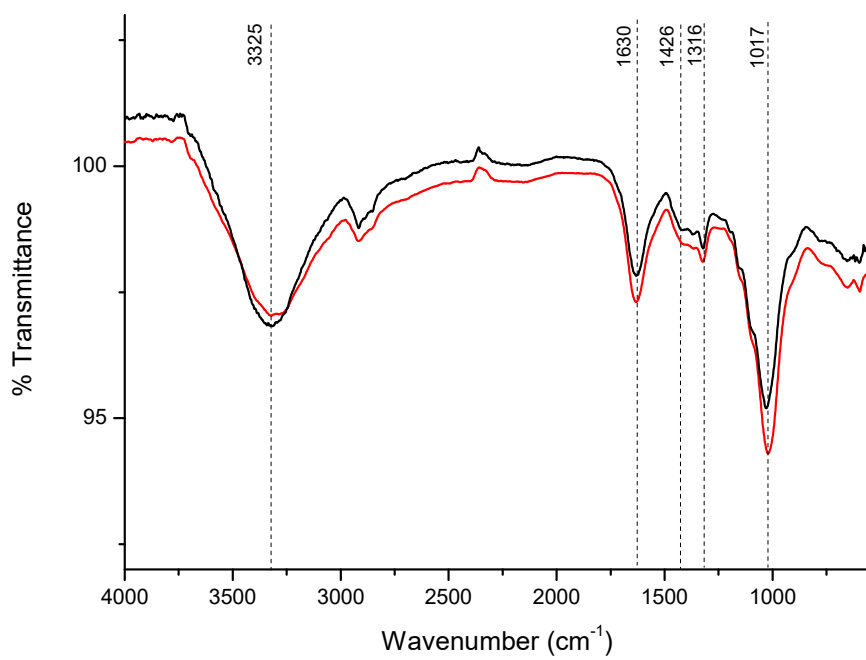


Figure S11. C Oxyrhynchus with ink (red) and without ink (black)

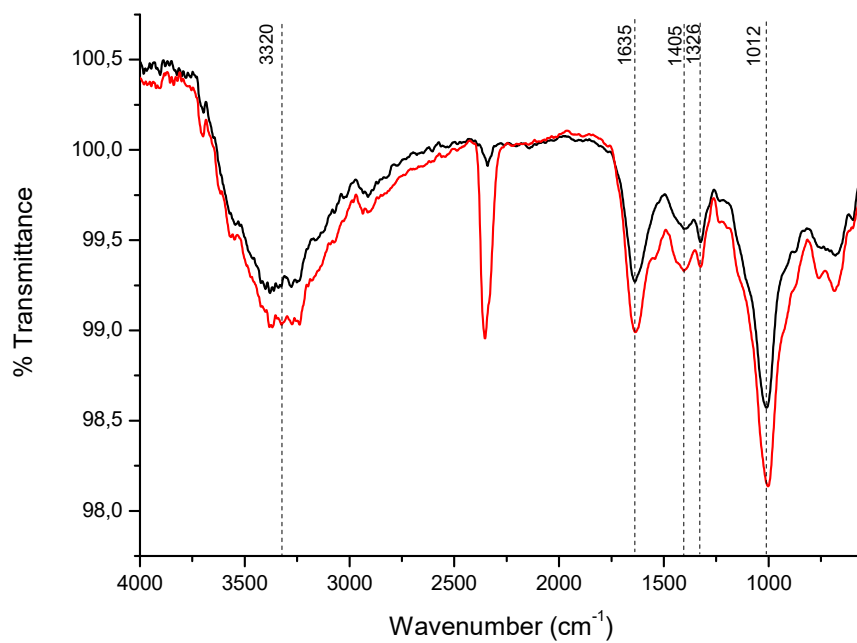


Figure S12. C' Oxyrhinchus with ink (red) and without ink (black)