Supplementary Material

HISTORIC LIME MORTARS COMPOSITION AND TERMINOLOGY FOR RADIOCARBON DATING – CASE STUDIES BASED ON THIN-SECTION PETROGRAPHY AND CATHODOLUMINESCENCE

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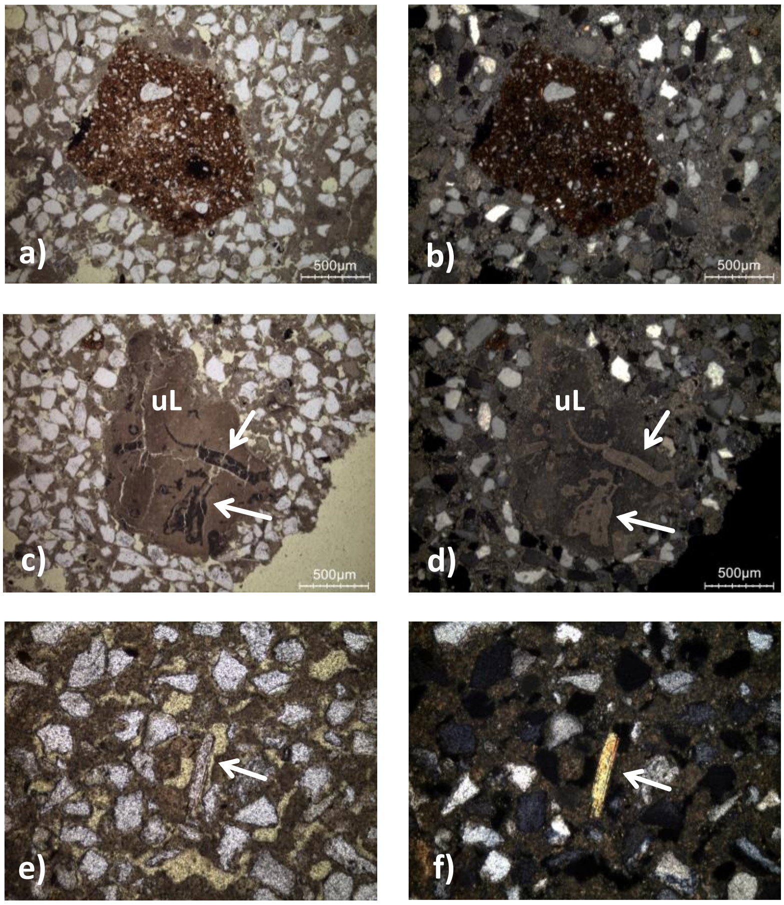

Figure S1: Petrographic images of mortar sample sp32 3A from the St Martin's church in Rutten (Belgium), it is a calcic air hardening lime mortar. a) plain polarised light (PPL) image of a sandy-clay agglomerate in reddish, the white inclusions around and inside the agglomerate are quartz and K-feldspars, the grey micritic binder surrounds them and the microporosity can be observed in light yellow; b) cross polarised light image (XPL) of the same sandy-clay agglomerate, the quartz and feldspar grains colour varies from white to different shades of grey and black ; c) PPL image of an underburned lime lump (uL, the arrows indicate remnants of fossils) ; d) same image in XPL ; e) PPL image of a mica flake shown by arrow ; and f) same image in XPL.

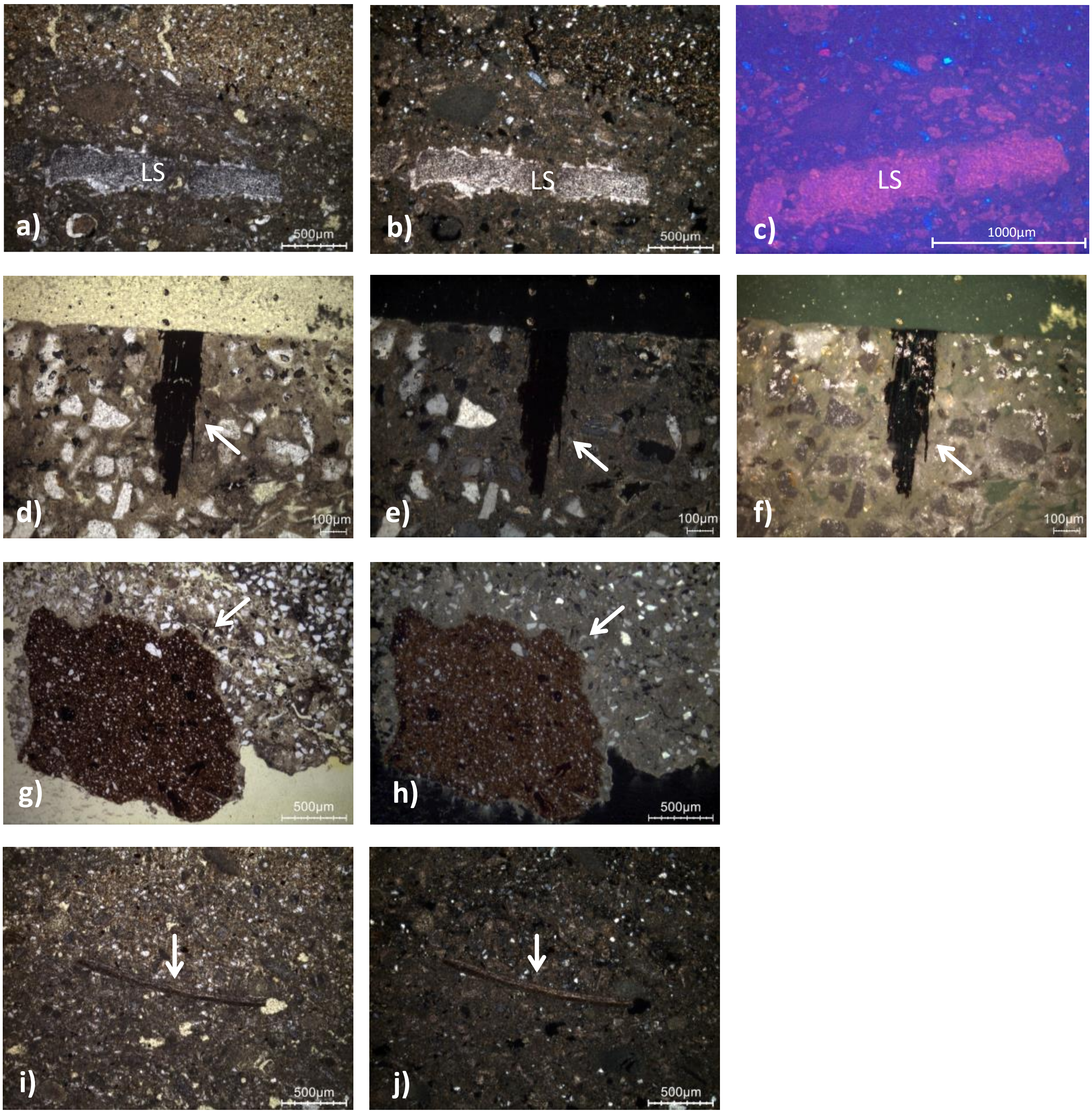

Figure S2: Images of mortar sample sp162 7B from the St Martin's church in Rutten (Belgium), it is a calcic air hardening lime mortar. a) PPL image of a large limestone fragment (LS) ; b) XPL image of the same LS fragment ; c) cathodoluminescence image of the same LS fragment (other smaller LS fragments are also noticeable in red, K-felspars appear in blue and the binder is dull) ; d) PPL image of a charcoal fragment ; e) XPL image of the same charcoal fragment ; f) incident light (IL) image of the same charcoal fragment ; g) PPL image of a sandy-clay agglomerate, the different shades of grey within the micritic binder is due to a partial dissolution in the lighter areas ; h) XPL image of the same sandy-clay agglomerate ; i) PPL image of a thin shell fragment ; and j) XPL image of the same thin shell fragment.

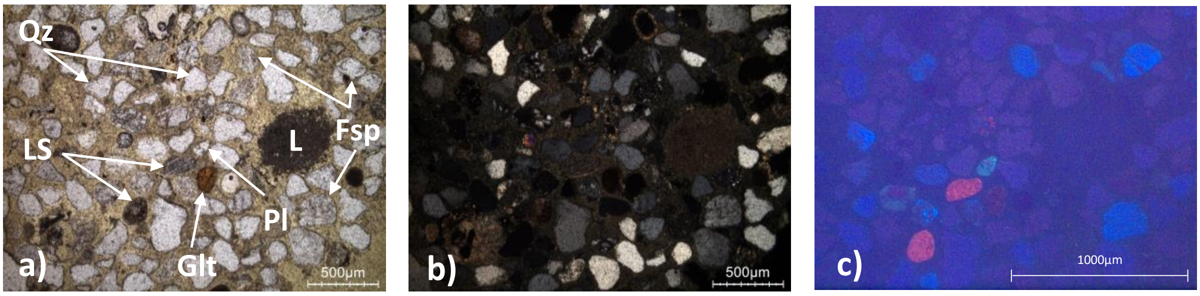

Figure S3: Images of mortar sample S7002-3 from Ten Bogaerde in Koksijde (Belgium), it is a calcic air hardening lime mortar with a partially dissolved binder. a) PPL image showing quartz (Qz), K-feldspar (Fsp) and plagioclase (Pl) as white/light grey subangular/subrounded grains, a partially oxidised glauconite grain in orange (Glt), rounded limestone (LS) fragments from the sand used as aggregate in dark grey, and a lime lump (L) ; b) XPL image of the same area of the thin-section ; and c) cathodoluminescence image of approximately the same thin-section area showing two calcareous grains in bright red, quartz grains in dark purple, bright blue K-feldspars, green plagioclases and the binder as well as the lime lump are dull.

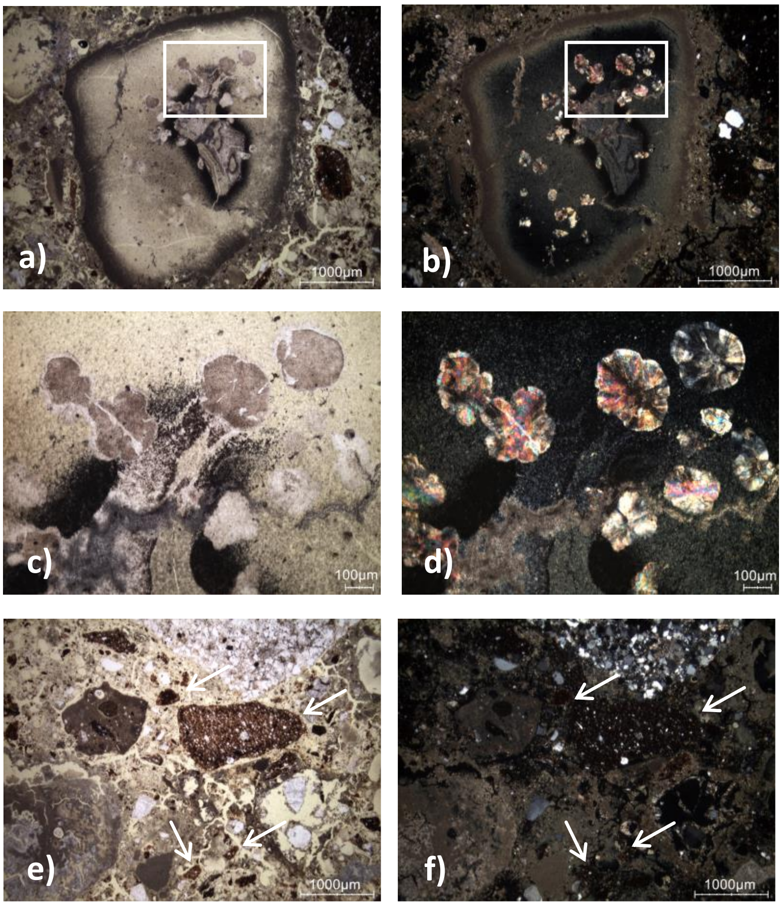

Figure S4: Petrographic images of the Roman mortar sample of Tongeren (Belgium), it was made with magnesian/dolomitic lime and it has hydraulic properties because of the presence of crushed ceramic fragments. a) PPL image showing spherical ghost fragments of hydromagnesite inside a lime lump ; b) same image in XPL ; c) PPL image showing zoom in on spherical ghost fragments of hydromagnesite replaced by calcite ; d) same image in XPL showing the interference colours of the 2nd to 3rd order of calcite ; e) subangular/subrounded ceramic fragments of different sizes scattered in the binder (the smaller ones are indicated with arrows) ; and f) same image in XPL.

Rutten sp32 3A			
Cumulated %C	^{14}C Age (BP)	^{14}C Age sig (BP)	Calendar Age (95.4 % probability)
0.18	1216	36	680-939 calAD
0.63	1176	33	772-975 calAD
1.18	1264	33	665-875 calAD
1.73	1389	33	597-757 calAD
10.63	1389	33	597-757 calAD
17.16	1399	32	596-670 calAD
35.15	1521	32	435-637 calAD
60.06	1560	32	425-575 calAD
Rutten sp162 7B			
Cumulated %C	^{14}C Age (BP)	^{14}C Age sig (BP)	Calendar Age (95.4 % probability)
0.17	1434	39	568-660 calAD
0.60	1484	34	544-646 calAD
1.24	1541	33	433-597 calAD
1.92	1606	35	408-550 calAD
8.93	1658	33	260-535 calAD
19.62	2179	31	365-149 calAD
41.80	2817	33	1107-847 calBC
71.53	3709	33	2202-1981 calBC
Koksijde S7002-3			
Cumulated %C	^{14}C Age (BP)	^{14}C Age sig (BP)	Calendar Age (95.4 % probability)
0.63	633	22	1294-1396 calAD
1.63	587	23	1305-1410 calAD
2.60	656	24	1283-1392 calAD
3.69	705	22	1271-1380 calAD
7.10	742	23	1229-1295 calAD
16.09	859	23	1157-1259 calAD
31.39	919	24	1037-1206 calAD
53.05	1001	23	992-1150 calAD
95.26	1848	24	127-241 calAD

Table S1: ^{14}C ages obtained for all the fractions of the three samples shown in the graphs Figure 2 (Rutten sp32 3A), 3 (Rutten sp162 7B) & 4 (Koksijde S7002-3) ; the values highlighted in green were combined to obtain an estimated date for each mortar sample.