ANALYSIS OF THREE SAMPLES FROM THE EVAN'S HOME, KILKENNY

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Report prepared for Carrig Conservation International Ltd. by:

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1. Introduction

This report contains the analysis of three samples from the Evan's home, Kilkenny, as tabulated below (Table 1).

Sample designation	Location of sample	Sample weight (g)
A	External harling	124
B	Internal plaster	218
C	External render used to create a trompe l'oeil window effect on a blind window ope	55

Table 1. Location of samples and sample sizes, the Evan's Home, Kilkenny.

The aims of the report are to determine the composition and other properties of Samples A and B and to establish whether sample C is similar to sample A.

2. Macroscopic description

The samples were inspected under a low powered stereomicroscope. Colours were matched with chips on a Munsell Rock-Color Chart (2009).

Sample A: This sample is very friable. It consists of a fine-grained binder, which is pale yellow grey in colour (5Y 8/1). The aggregate is very varied with gravel up to 20mm maximum dimension. Components of the aggregate include black and grey limestone, black chert, yellow sandstone and small amounts of crushed orange brown brick. White lime lumps are common. The proportion of aggregate to binder is at least 4:1.

Sample B: This sample consists of several coherent fragments with a thin layer of fine grained material with a smooth finish on one surface. The plaster below the fine grained material consists of a fine-grained binder, which is pale yellow grey in colour (5Y 8/1). The aggregate is very varied with gravel up to 10mm maximum dimension. Components of the aggregate include black and grey limestone, black chert, yellow sandstone, black shale and small amounts of crushed orange brown brick. White lime lumps are common

and some grains of charcoal were identified. The proportion of aggregate to binder is at least 4:1.

Sample C: This sample is very friable. It consists of a fine-grained binder, which is pale yellow grey in colour (5Y 8/1). The aggregate is very varied with gravel up to 10mm maximum dimension, but overall is finer than sample A. Components of the aggregate include black and grey limestone, black chert, yellow sandstone and small amounts of crushed orange brown brick. White lime lumps and tufts of hair are common. The proportion of aggregate to binder is at least 4:1.

3. Microscopic description

Because the samples were friable, they were impregnated in epoxy resin. Plaquettes were cut from the impregnated samples, using a diamond saw and were then cold mounted on glass slides. They were then reduced in thickness to 30μm and polished. Each section was scanned at high resolution on an Epson flat bed scanner (Figures 1, 2) before being examined in plane light and under crossed polars using a Nikon Eclipse petrographic microscope fitted with a Nikon DX1 digital camera. Images were opened in Photoshop CS3™ and illustrations were composed in Illustrator CS3™.

Sample A: This sample was particularly friable. The thin section (Figure 1) shows many grains of aggregate separated from binder and relatively few fragments including both aggregate and binder.

The aggregate consists of gravel (up to fine pebble grade) and coarse sand. The dominant rock type in the aggregate is sub-angular to sub-rounded chert; in addition there are significant quantities of rounded carbonate pebbles and granules, with several different varieties of limestone and dolomite represented; minor amounts of fine grained, quartz sandstone pebbles and granules; minor amounts of shale; and sand grade quartz and feldspar. The binder is cryptocrystalline calcite. A representative photomicrograph is shown in Figure 3. Because of the friable nature of the sample, the thin section is not suitable for estimating the ratio of aggregate to binder. In the few areas where aggregate grains are still contained within binder, the ratio is estimated visually to be at least 4:1.

Sample B: The sample was coherent (Figure 2). The aggregate consists of gravel (up to fine pebble grade) and coarse sand. The dominant rock type in the aggregate is rounded carbonate pebbles and granules, with several different varieties of limestone, including oolite, and dolomite; in addition there are significant quantities of pebbles and granules of fine grained, quartz sandstone and of vein quartz; minor amounts of sub-angular to sub-rounded chert; minor amounts of shale; and common sand grade quartz and feldspar. The binder is cryptocrystalline calcite. The ratio of aggregate to binder in the thin section was estimated by point counting (300 points) to be 4:1. A representative photomicrograph is shown in Figure 4.

4. XRD analysis

A small portion of each of the three samples was disaggregated and the fine fraction, which would have a higher proportion of the binder than in the original mortar, was pulverized in an agate pestle and mortar and the resultant powder was successively quartered to produce a final sample for analysis of 0.6g. The X-ray generator used was a Phillips PW1720 with a Philips PW1050/80 goniometer and a Philips PW3313/20 Cu k-alpha anode tube that was run with standard conditions of 40kV and 20mA. A soller slit and a 1° divergence slit were used on the incident x-ray beam and a 0.2° receiving slit followed by a 1° anti-scatter slit were used on the diffracted beam. A Philips PW 1752/00 curved graphite monochromator was used in front of the PW1711 proportional counter detector. The detector controller was a Philips 1710. All measurements were taken from 3 to 60 degrees (2θ) at a step size of 0.02 degrees/second.

Sample A: The XRD trace (Figure 5) shows the presence of calcite, dolomite, quartz, illite, chamosite and orthoclase feldspar. Of these, the calcite is from the binder and the remaining phases from the aggregate (quartz and orthoclase from sand and sandstone and from chert; illite from shale; and dolomite and some calcite from carbonate pebbles)

Sample B: The XRD trace (Figure 6) shows the presence of calcite, dolomite, quartz and gypsum. The quartz, dolomite and some of the calcite is likely to be from the aggregate. The remaining calcite is from the binder. The gypsum is either from the binder or from the fine grained material with a smooth finish.

Sample C: The XRD trace (Figure 7) shows the presence of calcite, dolomite,

gypsum and halite. The dolomite and some of the calcite is likely to be from the aggregate. The remaining calcite is from the binder. The gypsum is probably from the binder, unless an additional plaster is present, as in sample B. The origin of the halite (common salt) is not clear but it is probably in the binder.

5. Discussion and Conclusions

The aggregate used in all three samples is a gravel, almost certainly derived from local fluvio-glacial deposits. Although there are minor differences in the proportion of components (for example more chert and less limestone in Sample A compared to sample B), these differences are not significant. The aggregate in Sample C is a granule grade gravel, finer than in samples A and B, but generally similar in its composition.

The binder is lime-based in each case but contains gypsum in the case of Sample C and possibly in the case of Sample B. Hair has been used in Sample C but not in the other two samples.

A replacement mortar could be made from a gravel sourced in the Carlow/Kilkenny area and a lime based binder mixed in the ratio of 4:1.

George Sevastopulo
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Figure 1. Scanned image of Sample A, Evan's home, Kilkenny, showing gravel and coarse sand grade aggregate mostly free of binder. Area illustrated in Figure 3 is arrowed.

Figure 2. Scanned image of Sample B, Evan's home, Kilkenny, showing gravel and coarse sand grade in fine-grained binder. Area illustrated in Figure 4 is arrowed.

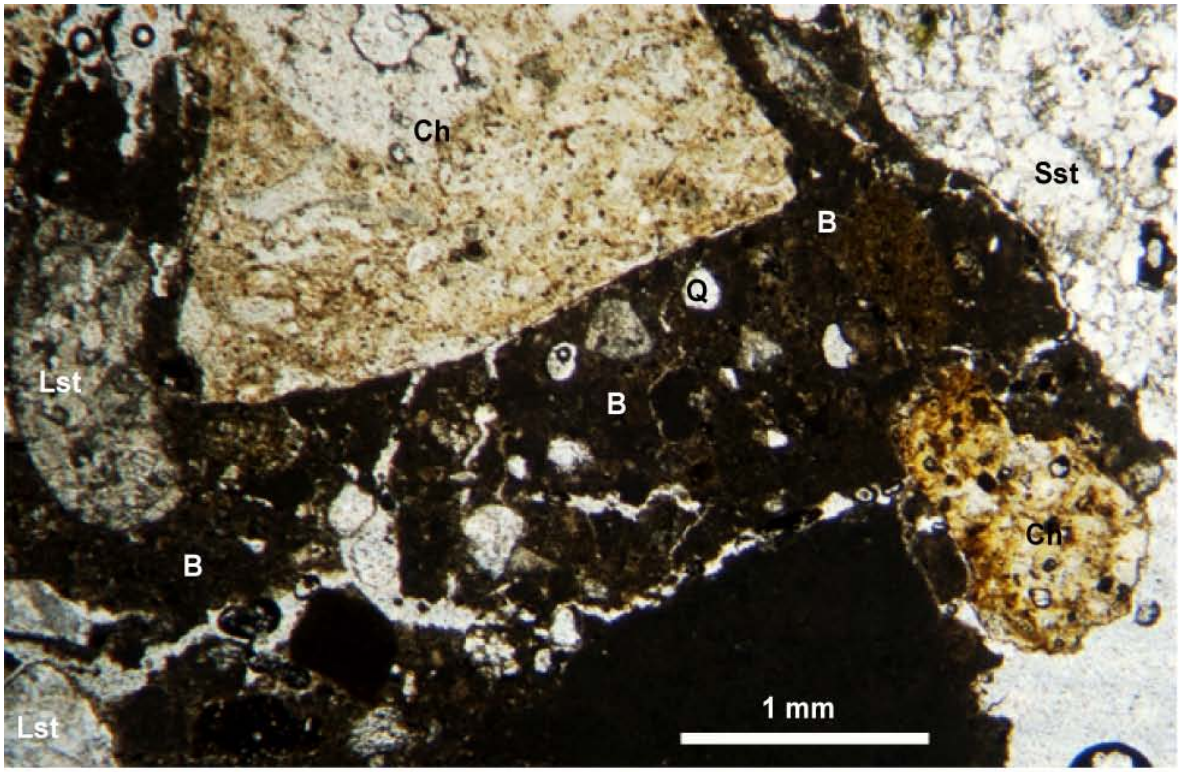

Figure 3a. Photomicrograph of thin section of Evan's home sample A in plane light, showing grains of chert (Ch), sandstone (Sst), limestone (Lst) and quartz (Q) in fine grained binder (B).

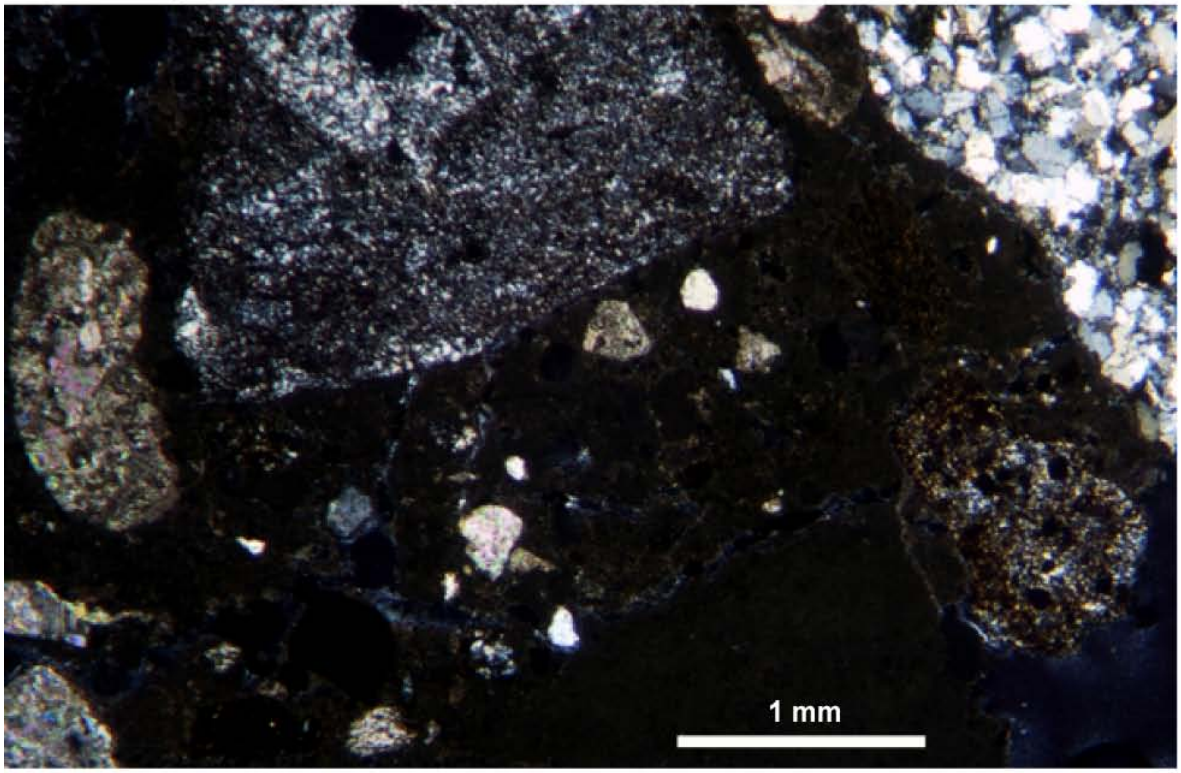

Figure 3b. Photomicrograph of thin section of Evan's home sample A under crossed polars. Same view as Figure 3a.

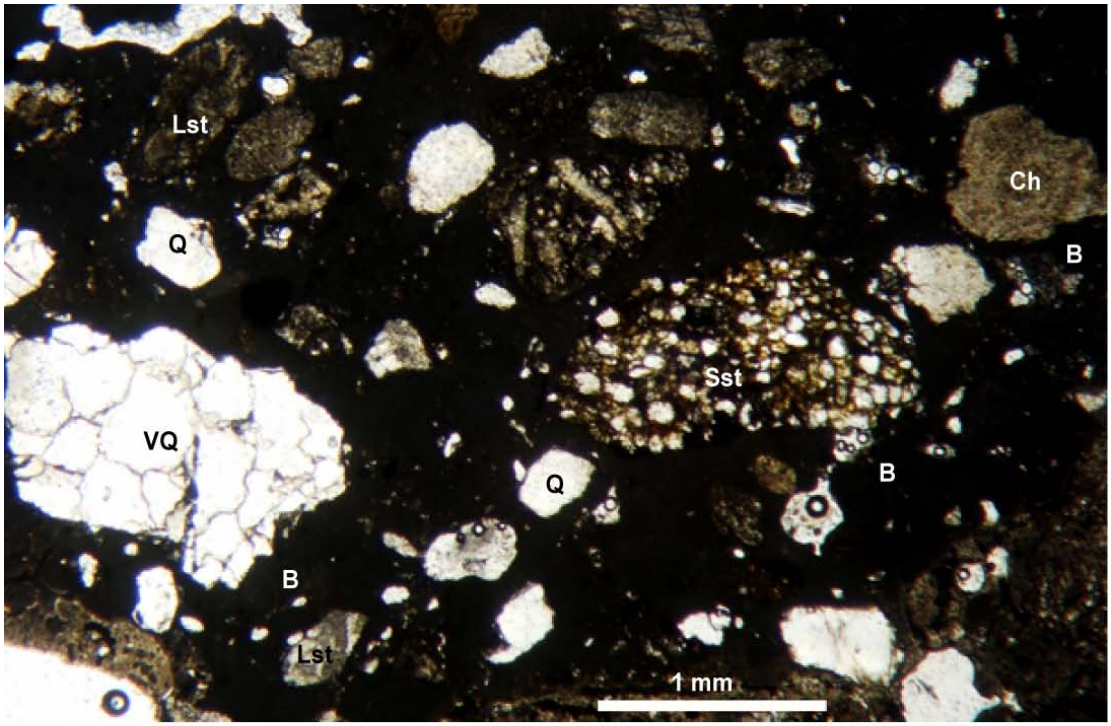

Figure 4a. Photomicrograph of thin section of Evan's home sample A in plane light, showing grains of chert (Ch), sandstone (Sst), limestone (Lst), quartz (Q) and vein quartz (VQ) in fine grained binder (B).

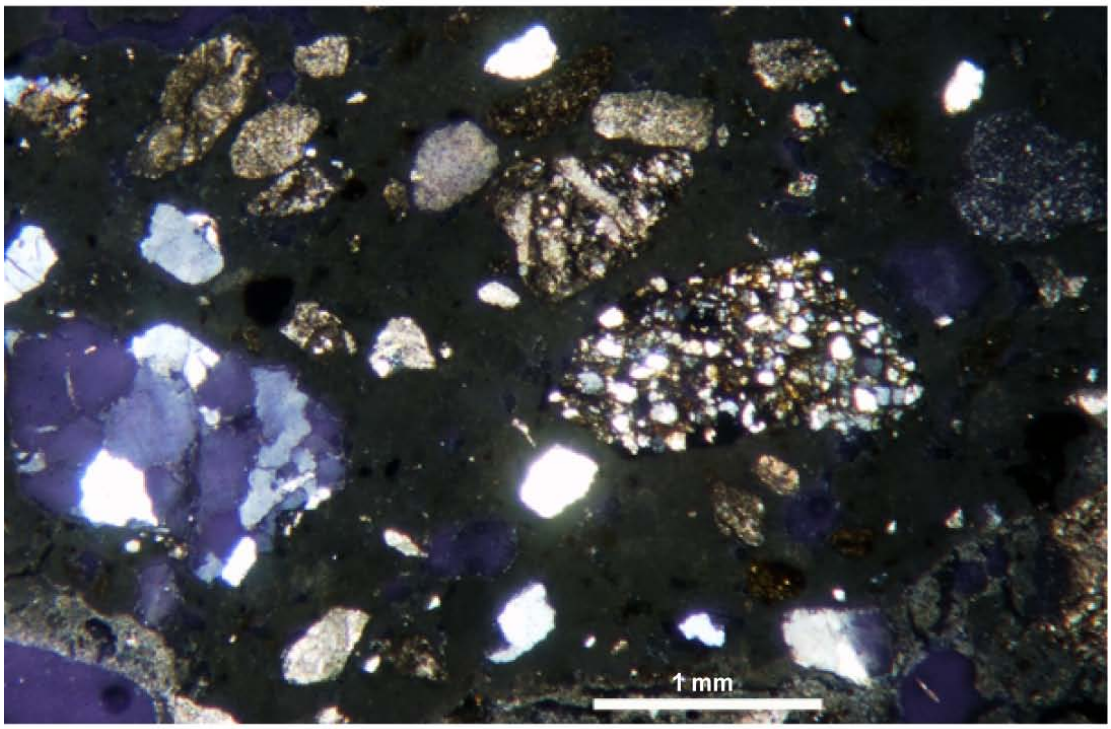

Figure 4b. Photomicrograph of thin section of Evan's home sample A under crossed polars. Same view as Figure 4a.

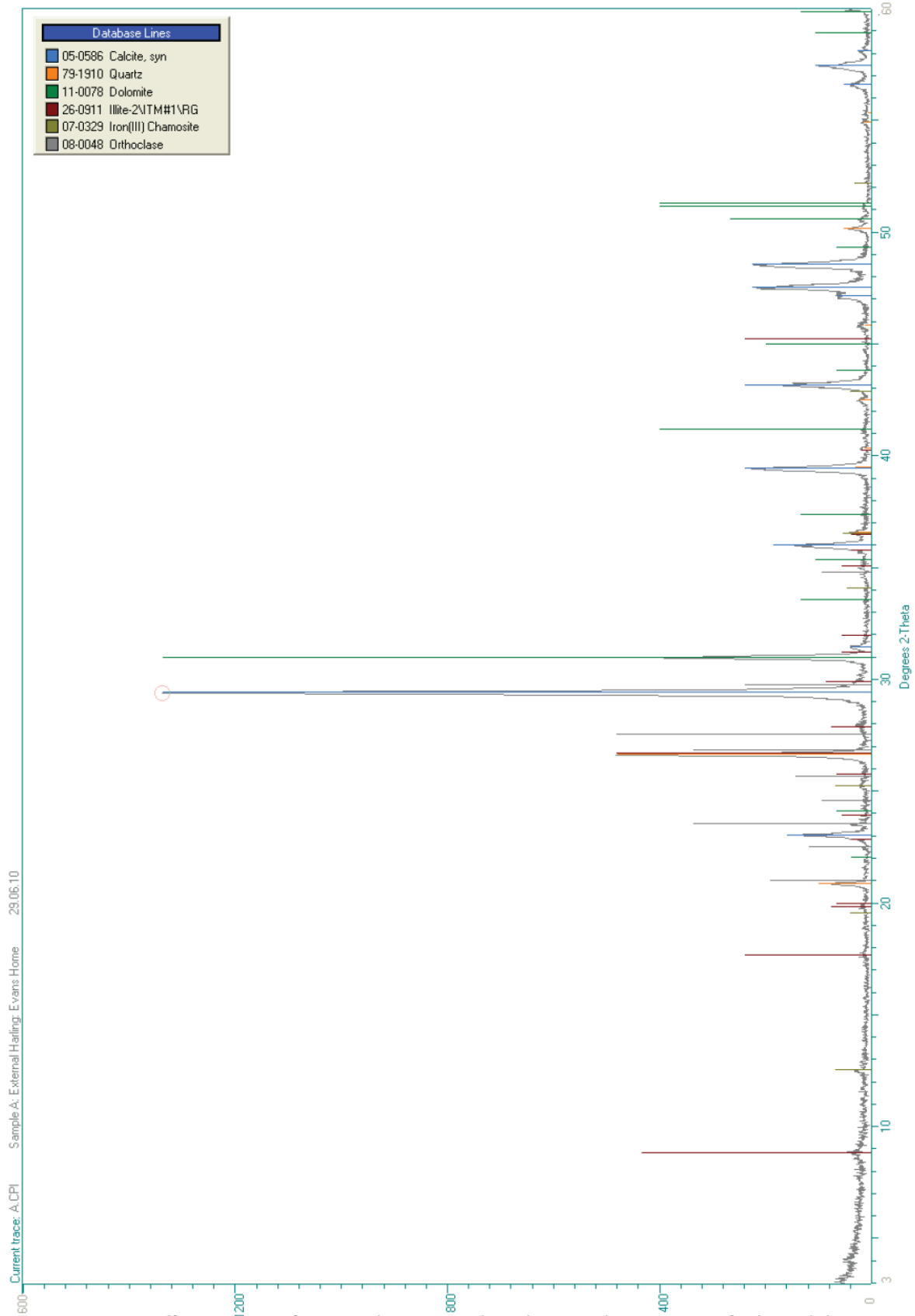

Figure 5. X-Ray Diffraction trace for Evan's home sample A showing the presence of calcite, dolomite, quartz, illite, chamosite and orthoclase.

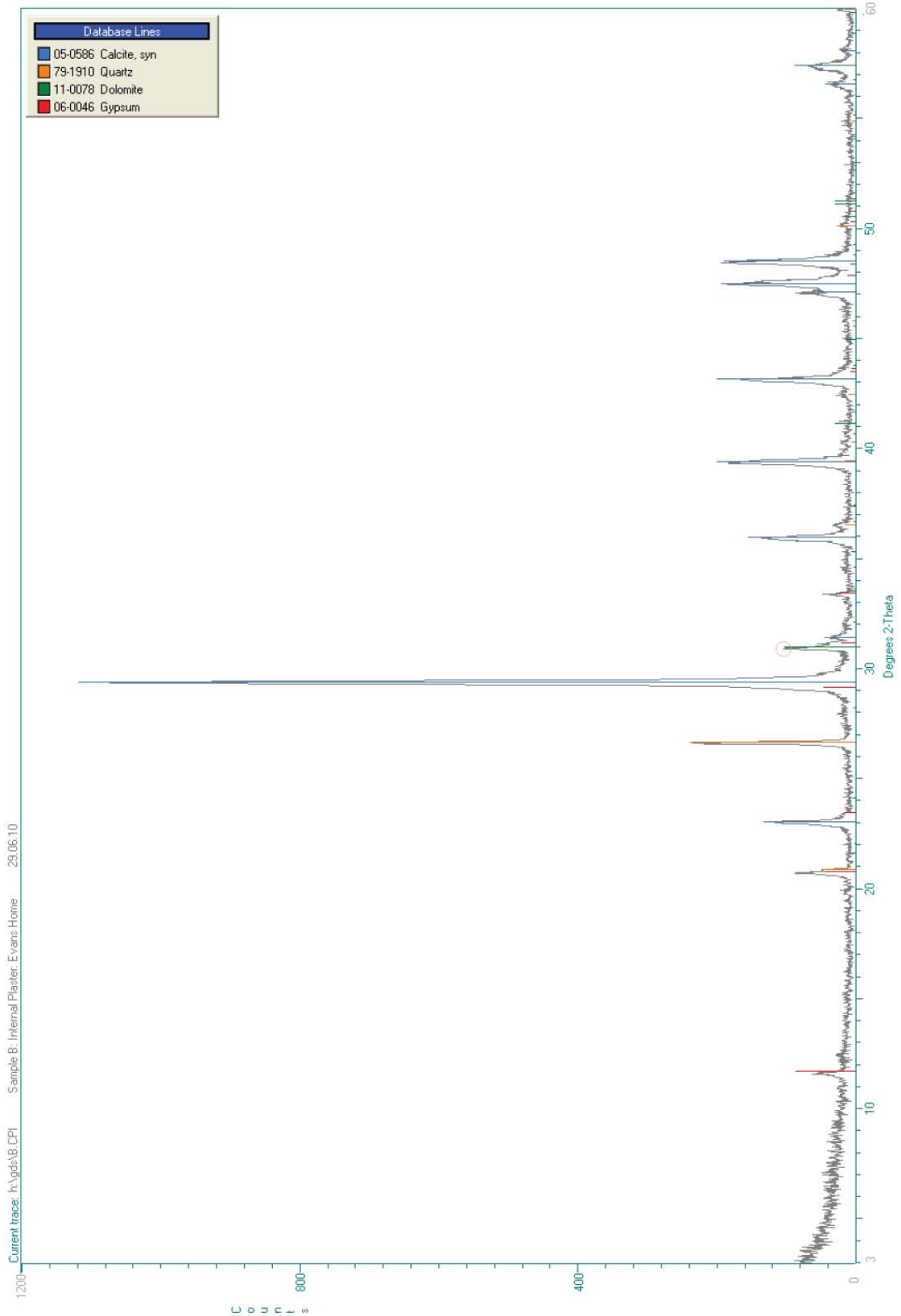

Figure 6. X-Ray Diffraction trace for Evan's home sample B showing the presence of calcite, dolomite, quartz and gypsum.

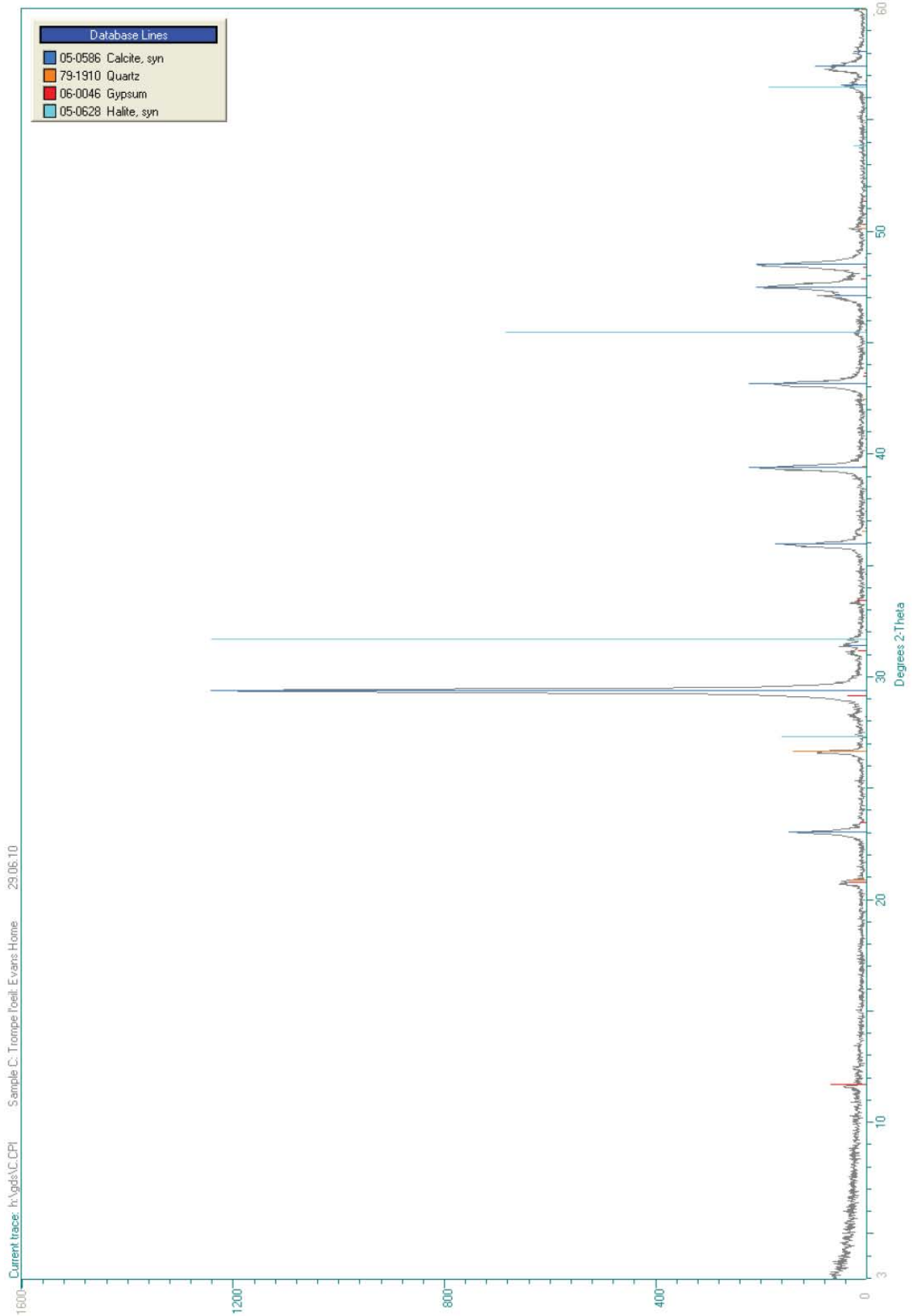

Figure7. X-Ray Diffraction trace for Evan's home sample C showing the presence of calcite, quartz gypsum and halite.