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# Examination of Mortar Samples from Willowford Bridge, Hadrian's Wall

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Seven examples of mortar (AM861999) from the excavations of the Hadrianic bridge at Willowford were examined visually and using low power optical microscopy. Representative and, as far as possible, uncontaminated samples of six of them were treated with dilute hydrochloric acid to determine the proportion of acid soluble material. The acid insoluble residues were also examined.

The samples were divided into two groups on archaeological grounds :
Group 1 : Samples 2 and 4, both from the Extension Wall phase and sample 5 which may also have been associated withthis phase.
Group 2 : Samples 1 and 7 from the Broad Wall phase, sample 6 from the Narrow Wall phase and sample 8 which might have been connected with either of these phases.

## Results

### Group 1

There was no significant difference between samples 2 and 4. Both were lime mortars, the aggregate in both cases included stones, sand, charcoal and old mortar and they each contained 31% by weight of acid soluble material. This figure is not an accurate reflection of the proportions of lime and aggregate in the original mortar as the aggregate contained some calcareous material.

Sample 5 was in a more degraded state than samples 2 and 4, and it differed

from them in certain respects. It contained a lower proportion of acid soluble material (27% by weight), and the acid insoluble residue was apparently contaminated with iron compounds. The residue, although otherwise similar to those of samples 2 and 4, also included a significant proportion of clay.

These differences do not prove that sample 5 was not originally essentially the same as samples 2 and 4 as they could be the result of degradation and contamination during burial. However, strong additional evidence would be required before it would be safe to conclude that sample 5 was from the same phase as samples 2 and 4.

Group 2

These samples were not only archaeologically distinct from those in group 1, but were also much coarser mortar and contained less calcareous material. All the samples in this group were badly degraded, and sample 1 was in such a poor condition that no analysis could sensibly be carried out. Samples 6,7 and 8 were coarse lime mortars containing aggregate which varied widely in size from stones several centimetres in diameter to fine sand. The acid insoluble residues also included some clay, but this may have been largely due to contamination.

Examination of the original samples and of the acid insoluble residues did not suggest that there were any significant differences between samples 6,7 and 8. There was a difference in the proportions of acid soluble material in samples 7 and 8 (15% by weight) and in sample 6 (20% by weight).

In view of the degraded nature of the samples, the results cannot be regarded as conclusive, but it appears more likely that sample 8 was from the Broad Wall phase represented by sample 7 than the Narrow Wall phase represented by sample 6, although it is possible that it was not related to either.