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Cleeve Abbey Frater Pavement cleaning analyses

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SUMMARY
Condition monitoring of the Frater Pavement at Cleeve Abbey has been carried out for a number of years both before and after the construction of a cover building in 2016. This report details the methods used and results obtained from examination of cleaning residues collected over the period 2008 - 2018. There is no evidence for any significant fragmentation, and every indication is consistent with the Frater Pavement being stable.

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INTRODUCTION

Historic England's Building Conservation and Geospatial Survey Team have managed a major research project at Cleeve Abbey since 2010, monitoring the mediaeval Frater Pavement in various environments. This resulted in the design and construction of a cover building over the pavement, finished in 2016 (Historic England 2015). The condition of the pavement has also been monitored over the past few years, since completion of the new building.

Sweepings or vacuum bags were retained during routine cleaning of the pavement over the years. The aim of this study is to detect pavement fragments in these sweepings, either indicating on-going loss, or a reduction in loss. Lack of fragments would be a verification of observations that the condition of the pavement has stabilised during the project.

SAMPLES AND METHODS

Nineteen dated samples of dust from cleanings of the pavement (or parts of it) have been saved since 2008. There is a designated trial area at the north end of the pavement, and the cleaning samples were from either this trial area (labelled TA), the rest of the pavement (ROP) or from the whole pavement (WP). In addition, a local topsoil sample was collected in 2019 from near the pavement and another from about 100 m away (see Table 1).

All samples were dried, and then subjected to particle size analysis by sieving down to 63 μm (i.e., the silt/sand boundary) in order to see if there any gross differences which could indicate processes affected either by pavement erosion or by soil input from outside. In addition, the particle size analyses yielded size fractions suitable for microscopic inspection to see if any pavement fragments could be found.

A sample of the Frater Pavement was broken up to produce fragments for comparative analysis.

RESULTS

Particle size analysis

Figure 1 shows the complete set of particle size analyses. The cleanings and soil samples all have similar slopes in the 2 mm to 63 μm sector, i.e., the fine, medium, and coarse sand component. This is to be expected, as the bulk of the cleaned material must be local soil. Four of the curves are, however, positioned significantly below the main group indicating a greater stone content. Two others within the upper main group show some crossing over of the curves between 2 and 3 mm, again indicating additional stones.

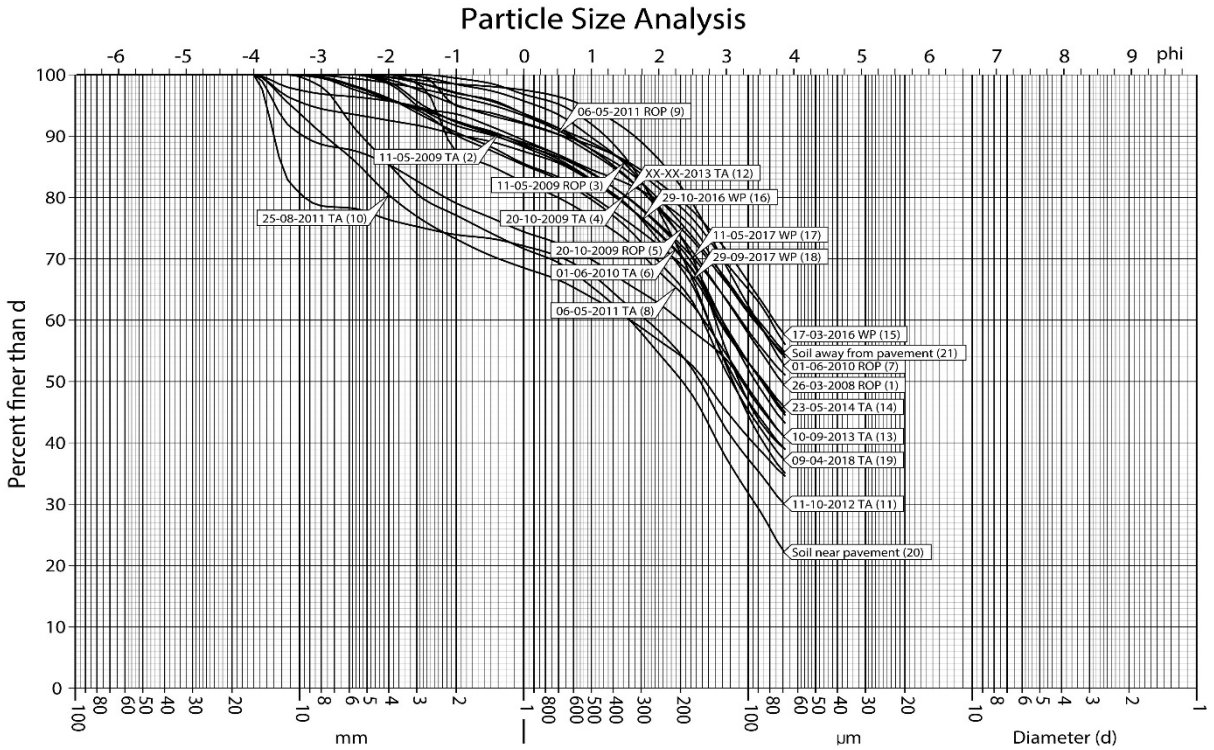

Figure 1: Particle size analyses of all the cleaning and soil samples. Sample labels consist of cleaning date, pavement area (TA = trial area; ROP = rest of pavement; WP = whole pavement), followed by laboratory number in brackets (see Table 1).

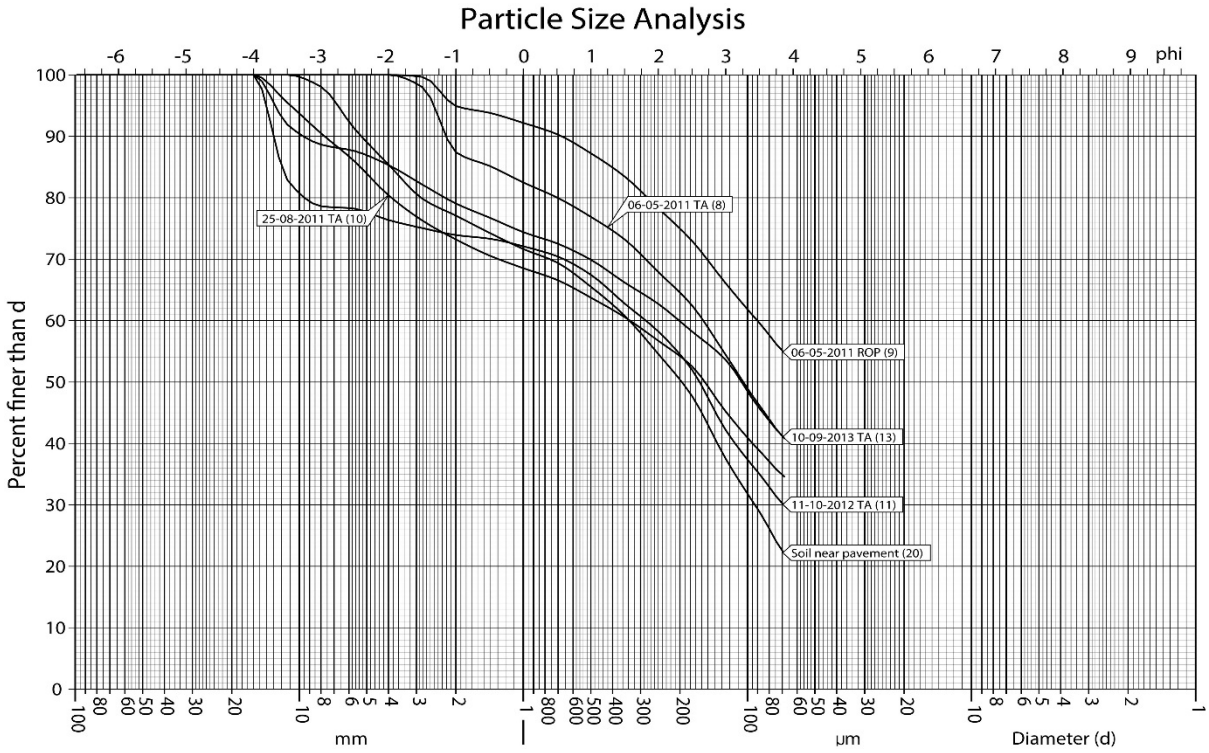

Figure 2: Particle size analyses of the six samples with higher stone contents. Sample labels consist of cleaning date, pavement area (TA = trial area; ROP = rest of pavement; WP = whole pavement), followed by laboratory number in brackets (see Table 1).

One of the samples with higher stone content (see Figure 2) is the local soil from near the pavement. However, the remainder (cleaning samples) are nearly all from the trial area and are all dated 2011-2013. The stone content most likely represents inputs from local soil or construction waste, via extreme weather, feet, accidents, or suchlike.

Microscopic examination

The particle size fractions (saved from the tests) were individually examined microscopically to check for pavement material. This entailed firstly a thorough examination of the broken-up pavement sample, followed by comparative examination of fractions from the different cleanings.

Frater Pavement comparative samples

The pavement has a number of different components at the microscopic scale. There is a basic oxidised red ceramic body (Figure 3a) which has about 5% rounded quartz grains of 1.0 – 0.1 mm in size and a few iron oxide grains of a similar size. Surface colouring of this red body can be found on the narrower border tiles, which are characterised by a black coating (Figure 3b). Other variants appear at the edges, where the red body has fired pinker (Figure 3c), or has a coarser sandy grey-pink fringe (Figure 3d).

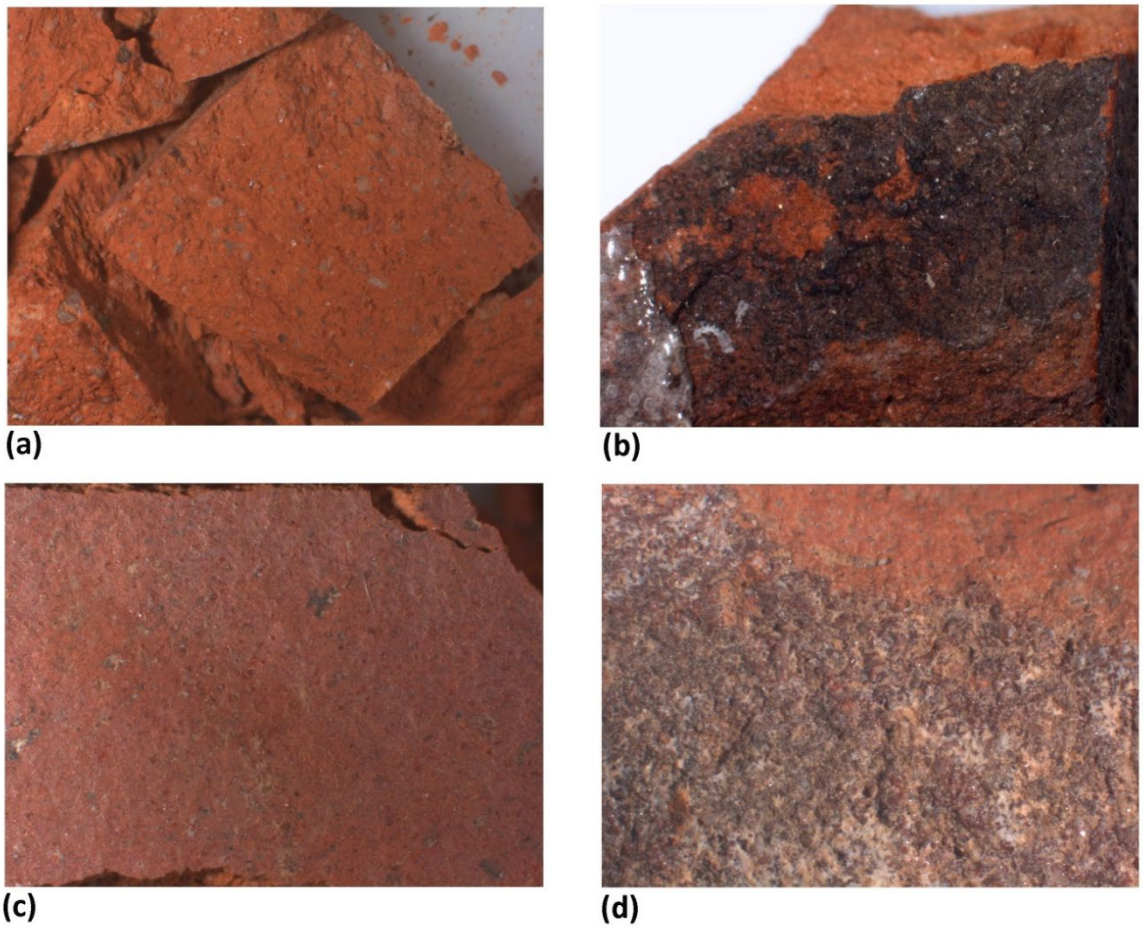

Figure 3: Frater Pavement oxidised red ceramic body: (a) normal colour and texture; (b) black surface coating on the narrower tiles; (c) edge variant, where the red material has fired pinker; (d) coarser grey-pink fringe.

The reduced part of the ceramic body is the same as the oxidised part except grey (Figure 4a), with occasional light brown patches (Figure 4b). The slip decoration is a very pure white (Figure 5a and b) with only a few additional grains of different types. The pavement also has a brown/yellow transparent glaze which can adhere to any of the different parts of the body or slip (Figure 6a, b and c).

Figure 4: Frater Pavement reduced ceramic body: (a) same as Figure 2 (a and b) except grey; (b) with occasional light brown patches.

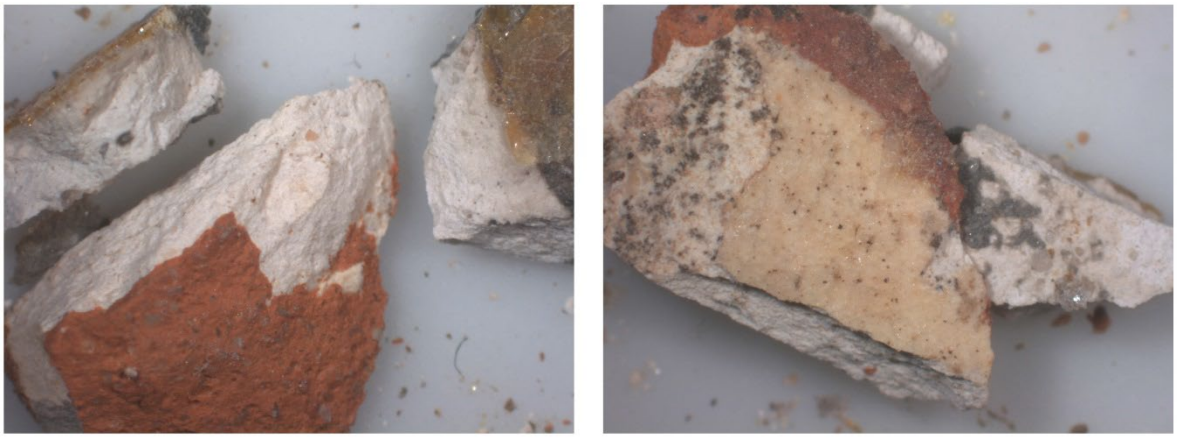

Figure 5: White slip decoration - generally a very pure white with few additional grains of different types.

Figure 6: Frater Pavement brown/yellow transparent glaze which can be found adhering to any of the different parts of the body or slip.

Frater Pavement fragments in the cleaning and soil samples

Two size fractions were examined for Frater Pavement fragments: >2mm and 1 – 2 mm. Smaller material was saved, but was difficult to identify with any certainty. This is because there is common tile in the soil samples and in most of the cleaning samples. These tile fragments tend to be a lighter orange than the Frater Pavement red (oxidised) body and also contain very little coarse material (i.e., quartz grains). They are generally distinguishable when larger than 1 mm, but look increasingly similar to pavement material when smaller pieces are examined.

The white part of the pavement (i.e., the slip decoration) is not easily distinguished from other white material in the sweepings or soil. It is, however, whiter than the average of the other grains, and similar-looking grains from the natural soils are generally rounded which is a very unlikely shape for pavement fragments.

The grey (reduced) part of the Frater Pavement is distinctive and can be clearly identified. There is a similar-coloured grey shillet material in the local soil, but it is platy in shape and can be distinguished by its mica content visible on the surfaces. It also frequently contains faint white stringers of quartz.

Table 1: Sample details and Frater Pavement fragments identified

			Frater Pavement fragments		
Lab no.	**Date of cleaning**	**Cleaning area**	**> 2 mm**	**1 – 2 mm**	**g analysed**
1	26/03/2008	Rest of the pavement	0	1	51.8
2	11/05/2009	Trial area	0	3	47.0
3	11/05/2009	and rest of pavement	0	0	49.9
4	20/10/2009	Trial area	0	1 (~3)	15.4
5	20/10/2009	and rest of pavement	0	4	49.0
6	01/06/2010	Trial area	0	0	46.7
7	01/06/2010	and rest of pavement	0	2	50.2
8	06/05/2011	Trial area	0	0	47.6
9	06/05/2011	and rest of pavement	0	0	49.2
10	25/08/2011	Trial area	0	0	47.4
11	11/10/2012	Trial area	0	0	50.8
12	XX/XX/2013	Trial area	0	1 (~1.5)	32.1
13	10/09/2013	Trial area	0	0	51.9
14	23/05/2014	Trial area	0	0	49.8
15	17/03/2016	Whole pavement	0	0	50.5
16	29/10/2016	Whole pavement	0	1 (~1.5)	30.1
17	11/05/2017	Whole pavement	0	0	28.8
18	29/09/2017	Whole pavement	0	0	3.6
19	09/04/2018	Trial area	0	1	45.6
		Comparative samples			
20		Near soil sample	0	0	17.63
21		100 m soil sample	0	0	47.5

In most cases, 45 – 50g of the cleaning dust was examined. This means that the numbers of pavement fragments recovered from each sample are broadly comparable. Only three samples (4, 12 and 16) should be multiplied up because of the smaller sample size, and the approximate values so produced are shown in brackets on Table 1. Sample 18 should probably be discounted altogether due to being only 3.6 g.

CONCLUSION

Only very small quantities of Frater Pavement fragments can be found in the cleaning samples. Although the quantities cannot really be treated as statistically significant, they do become fewer over time. They must represent individual events, accidents or stray pieces of waste left over from construction or maintenance. There is no sign of any form of systematic chipping or spalling in the size range reported here, and every indication is consistent with the Frater Pavement being stable.

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