

Using Sediment Loss on Ignition to Identify Late Woodland Housefloors at the Redtail Site (31YD173)

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Introduction

This research uses loss on ignition (LOI) of sediment samples to determine the dimensions of a previously identified housefloor and to test for additional housefloors at a Late Woodland settlement site in the upper Yadkin River Valley (URYV). Recent research identified housefloors after finding a correlation between high sediment organic content and low artifact density within 1x1m units (Scharer 2016). This was interpreted as being a result of the use of plant-based floor treatments and maintenance of house floors to keep them clear of ceramic and lithic objects (Krause et al. 2016).

During the summer of 2017, we collected sediment samples from units adjacent to those previously identified as part of the housefloor to find the northern boundary. We also collected sediment samples from two additional localities that were identified as potential housefloors during shovel testing in 2016. All of these samples were subjected to LOI analysis. Based on the results of these sediment tests, postmold patterns, and artifact concentrations, our previous interpretation of Redtail as a single household could be incorrect.

This research suggests it could have been multiple houses oriented along the river, potentially arranged in a linear pattern, similar to sites in adjacent river valleys like the Dan and the Eno (Ward and Davis 1993). In addition, this research identified another component between the housefloor and the potential housefloor that could represent a shared midden or activity space. Continued research in this geographic and temporal location is necessary to formulate a more comprehensive understanding of settlement patterns, social relations, and population sizes not only at the Redtail site but throughout the Upper Yadkin River valley as a whole.



Figure 1: Redtail site location and other 800-1600 CE sites in the Upper Yadkin River Valley.

Background

During the Late Woodland Period (AD 800-1600), particularly after AD 1300, in the North Carolina Piedmont, Piedmont Village Tradition communities were gradually coalescing, with villages and small hamlets appearing. In the upper Yadkin River Valley, we do not see strong evidence of coalescence occurring. Although we do not have strong evidence for villages--circular arrangements of 8-12 houses as they are seen in other valleys--we also do not have much evidence for what settlements did look like during this time. Much of this is related to relatively poor preservation conditions in many areas of the valley.

Since 2012, excavations at the Redtail site have produced data that suggested we may be able to explore household and settlement patterning. A single housefloor was identified by a high organic content in the soil resulting in the appearance of a distinct dark stained layer (apx. 12 x 18 m) correlating with visible postmolds and a low density of ceramic and lithic artifacts (Wright et al 2015, Krause et al 2016). This multi-faceted approach to the study of housefloors was developed in light of the poor preservation in this area. In 2016, a survey to the east of the site revealed the presence of more dark stained soil apx. 20 meters from the first identified housefloor, inspiring this research project. This area was partially excavated during 2017 and eventually expanded to include a third locality discovered during further surveys in order to see if two areas fit the expected model for housefloors at the site.

Methods

During the summer of 2017, we excavated nine 1x1m units across three localities at the Redtail site, beginning with the original housefloor (locality 1) and later expanding to two identified potential areas (localities 2 and 3). The two plowzones at each locality were screened with 1/4" mesh and undisturbed levels were screened with 1/16". All sediment samples tested for this project were taken from intact levels, where the original housefloor was found, placed in geologic sample bags or acid-free artifact bags.

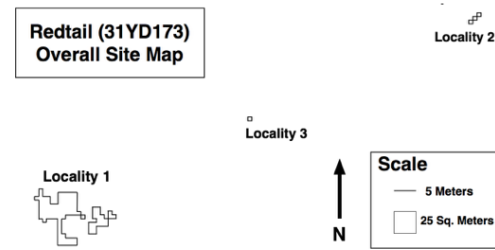


Fig. 2: Overall site map of excavated units at the Redtail site. The Yadkin river is directly north of each locality.

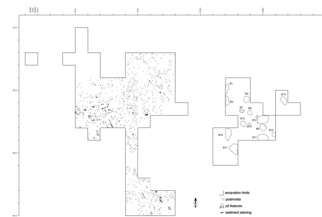


Fig. 3: Postmolds and features uncovered in Redtail locality 1.

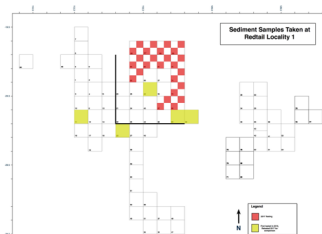


Fig. 4: Units tested from Redtail locality 1. The bolded line designates the approximate West and South edges of the housefloor.

Soil samples retrieved from throughout Redtail localities 1, 2, and 3 during excavations were sent for testing at the Archaeological Research Laboratory at the University of Tennessee through a measure of organic material called loss on ignition (LOI). LOI takes a sample of a known quantity of soil which is then heated in a furnace until the organic matter burns away. The soil is then weighed again and a calculation from the change in weight indicates the amount of organic matter that was in the soil prior to testing (Davies 1974). In this case, ~40g samples were placed in a tared quartz crucible, dried for 8 hours to minimize moisture at 105°C and then weighed. The samples were then placed in a muffle furnace and heated at 375°C for 12 hours and reweighed, according to Broadbent 1965. The resulting weight loss provides insight into the amount of organic material that was in the soil. In the results, we also discuss LOI results from Hadley Scharer's work, which was conducted in the Wake Forest University Archaeology Laboratories under the direction of Dr. Paul Thacker. Their methods were slightly different--drying the weighed samples overnight at 105 degrees, weighing the samples again and then firing them at 430 degrees for 2 hours. After the samples had cooled they were weighed for a third and final time.

Results

Redtail Locality 1 Housefloor

Unit #s	Crucible wt (g)	Crucible wt + sample (g)	Post 375 C burn wt (g)	Organic Matter %
Unit 67	45.24	92.9	91.96	1.01
Unit 67	40.12	90.73	89.77	1.06
Unit 68	39.9	89.71	88.73	1.09
Unit 68	41.21	88.29	87.4	1.01
Unit 73	39.98	89.82	88.87	1.06
Unit 73	38.58	83.17	82.28	1.07
Unit 74	42.7	98.62	97.54	1.10
Unit 74	41.2	82.04	81.18	1.05
Unit 75	36.8	77.56	76.75	1.04
Unit 75	36.91	81.27	80.4	1.07
Unit 81	44.85	93.34	92.37	1.04
Unit 81	34.67	80.82	79.83	1.22
Unit 82	40.01	88.14	87.22	1.04
Unit 82	42.73	94.43	93.46	1.03
Unit 83	40.66	92.46	91.28	1.28
Unit 83	38.43	86.36	85.44	1.07
Unit 84	38.69	95.28	94.05	1.29
Unit 84	36.53	91.71	90.55	1.26
Unit 46	44.29	94.33	93.4	0.99
Unit 63	36.62	81.02	80.13	1.10
Unit 64	36.56	73.88	73.19	0.93

Redtail Locality 1 Non-Housefloor

Unit 85	37.42	72.91	72.26	0.89
Unit 85	37.95	74.81	74.04	1.03
Unit 86	38.4	72.32	71.63	0.95
Unit 86	43.79	74.57	74.01	0.75
Unit 87	37.25	71.21	70.58	0.88
Unit 87	43.14	75.25	74.63	0.82
Unit 88	45.16	81.66	81.02	0.78
Unit 88	37.76	71.34	70.74	0.84
Unit 11	37.26	87.96	87.14	0.93
Unit 23	38.25	88.2	87.37	0.94

Redtail Locality 2

Unit 3	40.42	74.83	74.23	0.80
Unit 1	39.06	70.86	70.31	0.78
Unit 2	35.06	67.6	67.07	0.78

Redtail Locality 3

Unit 1	39.83	76.77	76.09	0.89
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Given that we were continuing this work in a new lab with different methods, we ran 5 samples from the same units run in 2015. The disparity between them could result from several factors related to the different methods used for heating in both projects (i.e. crucible type, temperature, heating duration, etc.). In 2015, the higher temperatures may have heated off other materials in addition to organic matter. Our analyses, with the larger samples and deeper crucibles, may not have completely fired off the organics. A combination of such factors likely explains the difference. That aside, the disparity across the 5 units is consistent enough that we feel confident converting between the two to look at larger trends. Finally, to ensure the results were not a factor of sediment acidity, we conducted pH testing.

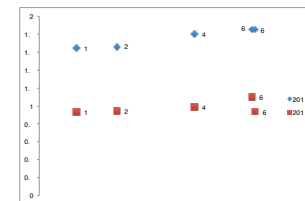


Fig. 5: graph of LOI results from 2015 and 2017 from the same excavation units.

Comparison of 2015 and 2017 results

Unit	2015 LOI	2017 LOI	2017/2015
11	1.64	0.93	0.568
23	1.66	0.94	0.567
46	1.8	0.99	0.548
63	1.85	1.10	0.594
64	1.85	0.93	0.505

2017 pH Testing of Redtail 2 and 3

Locality/Unit	pH Results
Redtail 2, Unit 1	4.97
Redtail 2, Unit 2	5.09
Redtail 2, Unit 3	5.11
Redtail 3, Unit 1	5.19

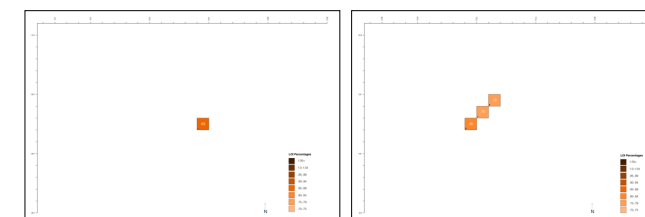
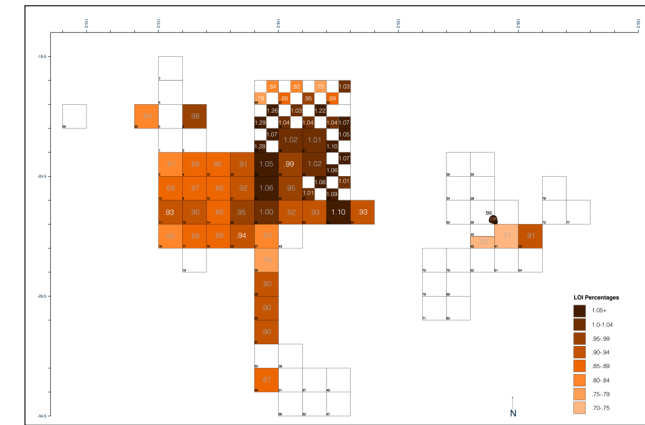


Fig. 6: LOI results for Redtail locality 1 (top), Redtail locality 2 (bottom right), and Redtail locality 3 (bottom left). The numbers in gray are converted from the 2015 results using an average of the values in the previous table.

Locality 2 has few artifacts compared to the first housefloor, but we uncovered over 50 postmolds across the 3 units. This is a density higher than that in the housefloor area in Locality 1. While it appears to represent a Late Woodland structure of some sort given these postmolds and the low artifact concentrations, it certainly differs from the first housefloor in organic content. We explore reasons for this in the discussion section.

The lack of postmolds and the high number of artifacts recovered at the sample unit at locality 3 do not follow the expected pattern of a housefloor at this site. However, it could represent an activity area or a midden, which would cause a high percentage organic material. The positioning of locality 3 between two housefloors is interesting and could represent a shared area.



Fig. 7: the image on the left shows postmolds in Redtail 2 unit 1. The middle shows postmolds in Redtail 2 unit 2. The right shows a pit feature in Redtail 3 unit 1.

Comparison of artifact counts between localities

Locality	Av. # of Ceramic Objects	Av. # of Lithic Artifacts
Redtail 1 Housefloor	10.5	11.0
Redtail 2	2.33	0
Redtail 3	17	13

Discussion

Given the high density of postmolds and low density of artifacts, we think that locality 2 is *near* another housefloor. The units adjacent and to the west of the housefloor in locality 1 have similar patterns of sediment organic content, postmold density, and artifact density. We expect that future excavation units in this area may uncover a similar pattern as seen in locality 1. That said, housefloor organic levels may be relative to surroundings and not absolute values. For example, if the house in locality 2 was occupied for a shorter time than the one in locality 1, we would expect the organic content to be lower. In such a scenario, we may have located a second housefloor already. The only way to determine which scenario is more accurate is through further sediment testing in locality 2.

The lower organic content, lack of postmolds, and much higher artifact concentration in locality 3 leads us to interpret this area as a midden or activity area between the two households.

This brings us to the curious case of locality 1, postmold patterns, LOI, and the size of the structure. We see two possible interpretations at this point:

1. The lack of clear patterning in postmolds is the result of frequent rebuilding of house structures as a result of wood rot in this humid climate and in slightly acidic floodplain sediments. The area of higher organic content is likely the area where shifting structures overlapped. In this interpretation, it is still possible to estimate house size. This distance from the middle of the higher organic content area to the edge of the postmolds is no more than 6m in any direction. This would suggest a single-family structure.
2. The postmolds are from various features adjacent to the house, such as drying racks, storage structures, etc. In this interpretation, the area of higher organic content and lower artifact density is the housefloor, with dimensions measuring approximately 4m x 5m. This also suggests a single-family structure.

Conclusions

More extensive excavations are necessary at localities 2 and 3 in order to define the boundaries and conduct further examination of sediment organic content, ceramic and lithic densities, and postmolds. What our research has come to realize is that LOI can be used to define housefloors relative to the area surrounding it, reducing the complications that arise from variations in occupation.

However, this research is able to confirm that these are prime locations for later excavations and studies examining pre-Columbian settlements in the Upper Yadkin River Valley during the Late Woodland Period as they do certainly represent areas of previous cultural activities. In addition, dating is crucial to developing an accurate understanding of the site and will be prioritized as these localities could represent various occupations, rather than different components of the same contemporary site.

Citations

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