

Sediment Stratigraphies of Archaeological Features at John de Graham's Castle, Upper Carron Valley

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Introduction

Sediment-stratigraphic approaches were used to test the hypothesis that the outer works of the castle, to its south, included fish ponds. Figure 1 is the most recent RCAHMS plan (SC_1563727) and shows the locations of the castle bailey and below it, to the east and south-west, the course of a very small stream, a putative dam in the south-west, partly quarried out on the east of the stream, with a pond and fish pond indicated.

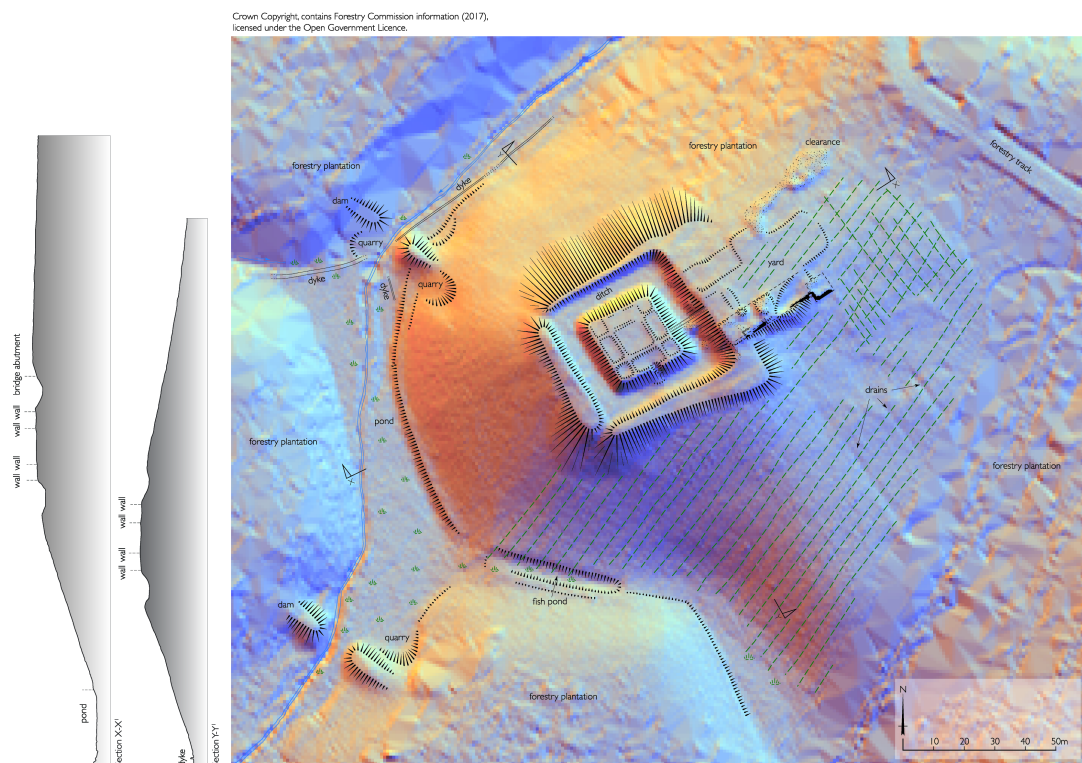


Figure 1. RCAHMS plan (SC_1563727)

Figure 2 is a plan of this area, made from hand-held GPS readings. The locations of the dam, quarry, pond and lower castle slopes are indicated to compare with Figure 1. The horizontal hachures show what is the present floodplain of the small stream. The shaded area is the outline of the wetland, defined by the growth of irises.

Methods

Two transects of boreholes were made with a hand-operated 1.0m long, 3.0cm diam. Eijelkamp peat gouge and extension rods. Transect 1 was broadly west-east, from B8 next to the stream to B5 above and outside the wetland. Transect 2 was broadly north east-south west from B9 beneath the lower slopes of the castle, through B1 and on to the quarry at B14. Also investigated was another area of wetland, Transect 3, located in Figure 1 by the dashed line south east of the fish pond.



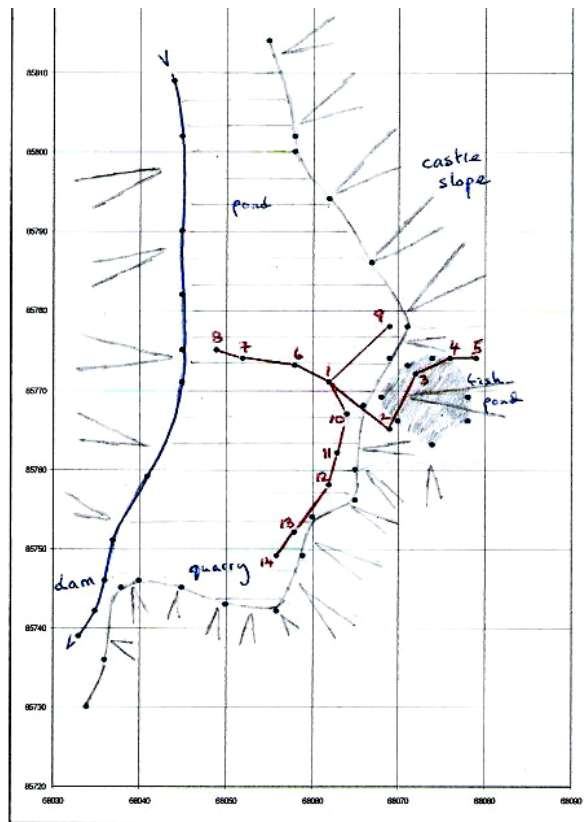


Figure 2. The area of the outer works of the castle investigated.

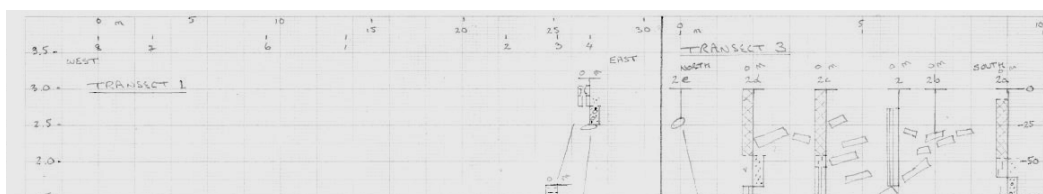
Sediment stratigraphies were recorded in the field, with colours, organic contents and particle sizes of mineral sediments estimated. Boreholes along Transects 1 and 2 were levelled to an arbitrary datum, the gravel bed of the stream near B8. The data are given in the Appendix and are illustrated in Figure 3. Each diagram in Figure 3 gives the length of the transect and the locations of boreholes along it. For Transects 1 and 2 the vertical axis is height above datum (m). For Transect 3 this is depth (cm) because these boreholes were not levelled to datum. Sediments in each borehole are depicted in two columns as either dominantly organic (o) or minerogenic (m).

Results

On Transect 1 (Figure 3), boreholes B8 to B2 depict sediments beneath the floodplain. The ground surface was at or well below the water-table during fieldwork in July 2016. Floodplain sediments are very thin. They are both minerogenic, dominated by silt, and organic, an *in situ* peat bed being inconsistently recorded. B2 is deeper, and above silts is a c. 60cm thick herb peat. The ground slope rises steeply east of B2. B3 is dominated by silts above a sedge-peat. B4 is very shallow and B5, not depicted in Figure 3, contained no sediment (Appendix). East of B5, within the fish pond (Figure 1) there is no sediment and no suggestion that there had once been sediments.

Transect 2 (Figure 3) is entirely of very thin floodplain sediments, which pass into herb peat by B10. Boreholes 13 and 14, within the quarry (Figure 1), have no sediment.

Transect 3 is a c. 10m cross-section at one point (NS 68165 85744 in the south to NS 68171 85751 in the north) across the narrow wetland. Coring was difficult because the uppermost metre or so has a great amount of stone. Below this and a muddy sediment, there is in the centre c. 1.75m of herb peat, almost entirely organic, over silts and clays.



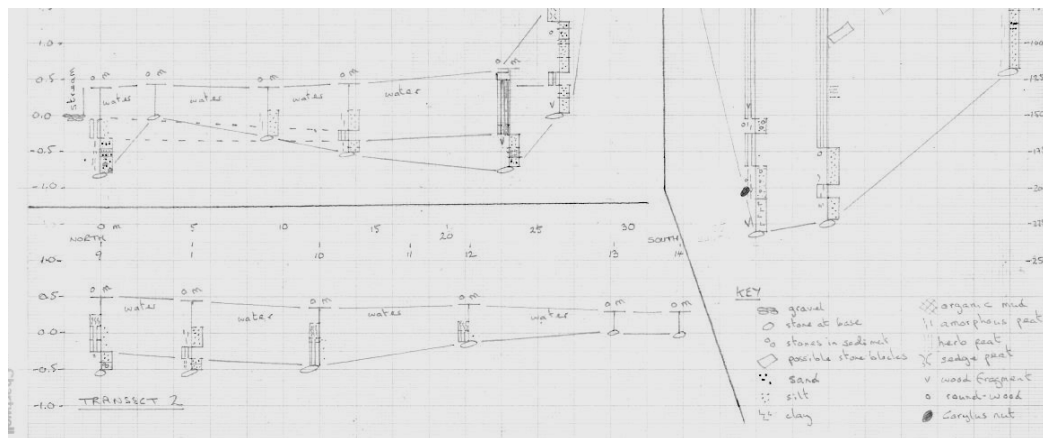


Figure 3. The results of sediment-stratigraphic transects along Transect 1 (top left), Transect 2 (bottom left) and Transect 3 (right). The key to sediments and features within the sediments is given below Transect 3.

Discussion

The archaeological evidence for a dam in the south west corner of the castle earthworks (Figures 1, 2) is convincing. It would be of value to determine the altitude of the dam surface, and assuming the water so dammed to have a surface at this altitude, project upstream to define the former extent of a pond with more precision than at present. The dam at the head of the pond (Figure 1) was not inspected by RT during fieldwork. It may have been necessary to maintain water depth and quality in the pond downstream. The small stream at present, though insignificant, has a steep gradient and has the capacity to transport quite coarse gravel in spates, though in a landscape disturbed by afforestation.

Sediments beneath the floodplain surface along Transects 1 and 2 provide no evidence for having been ponded, however. They are laterally continuous layers of peat and silt which, almost certainly, have a fluvial origin. Valley-floor peat would typically represent phases of landscape stability, with limited overbank flooding. B2 has the thickest peat because this probably lies in a backwater or former meander, and is the most intact because it is at the greatest distance from floodwaters issuing from the stream. Minerogenic layers are flood deposits, and there is a suggestion in B8-B1 that silt layers thin away from the stream.

The sediment stratigraphy at B2 was re-visited and sampled by a closed-chambered 1.0m long, 6.0cm diameter Russian peat corer. Basal minerogenic sediment was penetrated. A 1.0cm thick slice of basal amorphous peat (91.0-92.0cm depth) was submitted to SUERC for AMS ^{14}C dating. The assay was received on 18th April 2018. The peat has an age at 95.4% probability of 5208-4998 cal BC (6132±22 ^{14}C BP: SUERC-78942 (GU47241)).

The preservation of thick peat in B2 within a natural landform, an abandoned meander, with an earliest age of c. 5100 BC strongly suggest that natural landscaping processes have been dominant. The sediments represent the slow, gradual or intermittent accumulation of peat and overbank flood deposits along a small stream. These data suggest that the archaeological features have been wrongly interpreted.

Transect 3 records a sediment stratigraphy that was totally surprising, and which will reward further work. The age of a *Corylus* (hazel) nut at 202cm depth, very close to the base of the stratigraphy at borehole B2d, was submitted for AMS ^{14}C dating by SUERC on 8th September 2017. The assay was received on 18th November 2017 (see attached .pdf). The *Corylus* nut has an age at 95.4% probability of 3091-2917 cal BC (4386±28 ^{14}C BP: SUERC-75886 (GU45454)). The peat began to form close to c. 3000 cal BC, within the Neolithic period. Assuming that it formed continuously, without hiatus, and is still forming, the peat formed at around 0.04cm/yr (c. 25 yrs/cm). This is very slow and probably implies that these assumptions are false.

The origin of the gully/ditch containing the peat is very unclear. It lies at the base of a

The origin of the gully/ditch containing the peat is very unclear. It lies at the base of a subglacial drainage channel on its eastern slope that at c. 3000 cal BC was deeply incised. The sides of the gully/ditch are much steeper than the adjacent till (boulder clay) slopes (not depicted in Figure 3), and if originally natural, perhaps suggested by the layers of clay and silt at its base, it is hard to see where the erosive energy of the stream was generated on this gentle slope. An alternative explanation is that it is a ditch, though not for defence.

Appendix: Borehole Data and Sediment Descriptions

Borehole 1/1	NS 68062 85771 (ground surface 0.45m above stream bed)
<i>Depth (cm)</i>	<i>Description</i>
0-38	Not sampled: water and uncompacted vegetation
38-64	Pale brown structureless silt with common amorphous organic matter (AOM); sharp boundary to
64-78	Mid-brown herb peat; gradual to
78-87	Mid-brown structureless silt with common amorphous organic matter (AOM); sharp to
87-93	Dark brown structureless silt with common amorphous organic matter (AOM): bottomed on gravel

Borehole 1/2	NS 68069 85765 (ground surface 0.67m above stream bed)
<i>Depth (cm)</i>	<i>Description</i>
0-15	Not sampled: water and uncompacted vegetation
15-29	Black uncompacted vegetation in AOM; sharp to
29-44	Pale brown herb peat with much AOM and abundant mineral matter 39-44cm; gradual to
44-80	Pale brown herb peat with common mineral matter; gradual to
80-92	Dark brown herb peat with common mineral matter; sharp to
92-111	Mid-brown structureless silt with single large wood fragment 92cm and common AOM, declining down-unit; gradual to
111-114	Dark grey structureless clay with common fine fleshy plant stems and many small rootlet channels; gradual to
114-122	Pale brown to pale grey structureless clay with rare fine fleshy plant stems and one small weathered stone 117-118cm; sharp to
122-137	Pale brown structureless sand with silt and one small stone 135cm: bottomed on gravel

Borehole 1/3	NS 68072 85772 (ground surface 1.73m above stream bed)
<i>Depth (cm)</i>	<i>Description</i>
0-12	Not sampled: water and uncompacted vegetation
12-42	Uncompacted Cyperaceae-rich peat; sharp to
42-52	Mid-brown structureless silt with rare sand, common AOM and occasional-common fine fleshy stems; sharp to
52-68	Dark brown structureless silt with rare sand, common AOM, common-abundant fine fleshy stems and single small round-wood 60cm; sharp to
68-74	Mid-brown structureless silt with rare sand, common AOM and occasional-common fine fleshy stems; gradual to
74-89	Pale brown structureless silt with rare sand, common AOM and occasional-common fine fleshy stems; gradual to
89-111	Mid- to dark brown structureless silt with rare sand, common AOM and occasional-common fine fleshy stems; sharp to
111-127	Dark brown herb peat; gradual to
127-139	Dark grey structureless to weakly bedded silt with much AOM, occasional fine fleshy stems and rare small round-wood, common 127-131cm; gradual to
139-146	Very dark grey structureless to weakly bedded silt with abundant AOM; sharp to
146-167	Dark grey structureless silt with single medium wood fragment 150cm and occasional AOM: bottomed on stone

Borehole 1/4	NS 68076 85774 (ground surface 3.15m above stream bed)
<i>Depth (cm)</i>	<i>Description</i>
0-12	Not sampled: water and uncompacted vegetation
12-25	Uncompacted Cyperaceae-rich peat; gradual to
25-40	Increasingly compacted mid-grey coarse herb peat with common-much mineral matter and very rare sand; gradual to
40-64	Pale brown structureless silt with common sand, rare small stones 40-42cm, common intrusive fibrous roots 40-47cm: bottomed on gravel

Borehole 1/5	NS 68079 85774 (ground surface 4.10m above stream bed)
<i>Depth (cm)</i>	<i>Description</i>
0-52	Not sampled: water and uncompacted vegetation: bottomed on gravel

Borehole 1/6	NS 68058 85773 (ground surface 0.40m above stream bed)
<i>Depth (cm)</i>	<i>Description</i>
0-38	Not sampled: water and uncompacted vegetation
38-68	Mid-brown structureless silt with common AOM and common fine fleshy stems, declining to few below 50cm: bottomed on stone

Borehole 1/7	NS 68052 85774 (ground surface 0.44m above stream bed)
<i>Depth (cm)</i>	<i>Description</i>
0-45	Not sampled: water and uncompacted vegetation: bottomed on stone

Borehole 1/8	NS 68049 85775 (ground surface 0.39m above stream bed)
<i>Depth (cm)</i>	<i>Description</i>
0-45	Not sampled: water and uncompacted vegetation
45-70	Mid- to dark grey herb peat with common-much mineral matter; gradual to
70-83	Pale to mid-brown structureless silt with rare sand, common 72-75cm, and occasional AOM; sharp to
83-88	Very dark grey structureless silt with much AOM; sharp to
88-96	Pale to mid-brown structureless silt with rare sand and occasional AOM; sharp to
96-118	Dark grey structureless silt with common sand and rare small-medium stones, common AOM and common fine fleshy stems 83-86cm: bottomed on gravel

Borehole 1/9	NS 68069 85778 (ground surface 0.50m above stream bed)
<i>Depth (cm)</i>	<i>Description</i>
0-24	Not sampled: water and uncompacted vegetation
24-38	Uncompacted vegetation; gradual to
38-61	Pale brown herb peat with common mineral matter; gradual to
61-75	Dark brown herb peat with rare mineral matter; sharp to
75-85	Dark grey structureless silt with common AOM and occasional fine fleshy stems; sharp to
85-88	Very dark grey structureless silt with many fine fleshy stems and common-many rootlet channels; sharp to
88-98	Pale grey poorly sorted structureless silt with abundant small-medium stones: bottomed on gravel

Borehole 1/10	NS 68064 85767 (ground surface 0.37m above stream bed)
<i>Depth (cm)</i>	<i>Description</i>
0-22	Not sampled: water and uncompacted vegetation
22-39	Uncompacted vegetation; gradual to
39-46	Pale brown herb peat with common mineral matter; gradual to
46-80	Dark brown herb peat with rare mineral matter: bottomed on stone

Borehole 1/11	NS 68063 85762 (ground surface 0.38m above stream bed)
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<i>Depth (cm)</i>	<i>Description</i>
0-24	Not sampled: water and uncompacted vegetation
24-35	Slightly compacted vegetation mat; gradual to
35-49	Pale brown herb peat with common mineral matter; gradual to
49-64	Dark brown herb peat with rare mineral matter: bottomed on stone

Borehole 1/12 NS 68062 85758 (ground surface 0.31m above stream bed)	
<i>Depth (cm)</i>	<i>Description</i>
0-25	Not sampled: water and uncompacted vegetation
25-37	Slightly compacted vegetation mat; gradual to
37-50	Dark brown herb peat with rare mineral matter: bottomed on stone

Borehole 1/13 NS 68058 85752 (ground surface 0.30m above stream bed)	
<i>Depth (cm)</i>	<i>Description</i>
0-55	Not sampled: water and uncompacted vegetation: bottomed on stone

Borehole 1/14 NS 68056 85749 (ground surface 0.29m above stream bed)	
<i>Depth (cm)</i>	<i>Description</i>
0-32	Not sampled: water and uncompacted vegetation: bottomed on stone

Borehole 2a NS 68175 85752 (1.0m from southern edge of peat)	
<i>Depth (cm)</i>	<i>Description</i>
0-7	Not sampled
7-48	Very sloppy poorly compacted organic mud; gradual to
48-61	Dark brown amorphous peat with some mineral matter; sharp to
61-78	Mid-brown structureless silt with rare small stones, common below 71cm, some AOM and occasional vertical coarse fleshy stems; gradual to
78-117	Dark brown structureless silt with two bands of dark grey grit, with sharp lower and upper boundaries at 86 and 89cm, with common AOM: bottomed on stone

Borehole 2b NS 68175 85752 (3.0m from southern edge of peat)	
<i>Depth (cm)</i>	<i>Description</i>
	Stone between 30 and 70cm depth in several closely spaced boreholes

Borehole 2 NS 68175 85752 (4.0m from southern edge of peat)	
<i>Depth (cm)</i>	<i>Description</i>
0-14	Not sampled
14-67	Mid- to dark brown herb peat: bottomed on stone

Borehole 2c NS 68175 85752 (6.0m from southern edge of peat)	
<i>Depth (cm)</i>	<i>Description</i>
0-46	Very sloppy poorly compacted organic mud; gradual to
46-54	Mid- to reddish-brown amorphous peat; gradual to
54-173	Reddish-brown herb peat with very large stone c. 100cm (stone also between 20 and 50cm depth in several closely spaced boreholes) and pale brown mineral bands 128-138cm; sharp to
173-198	Pale to mid-grey structureless silt with diffuse patches of dark brown AOM, single large round-wood 181cm and single small round-wood 176cm and very rare Cyperaceae stems 191-195cm: sharp to
198-206	Dark brown amorphous peat; sharp to
206-222	Mid- to dark grey structureless silt with much AOM 214-219cm and rare Cyperaceae stems 213cm: bottomed on stone

Borehole 2d NS 68175 85752 (8.0m from southern edge of peat)	
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<i>Depth (cm)</i>	<i>Description</i>
0-46	Very sloppy poorly compacted organic mud; gradual to
46-67	Pale brown structureless silt with single medium wood fragment 62cm; sharp to
67-153	Dark reddish-brown herb peat with single medium wood fragment 144cm; gradual to
153-163	Reddish-brown structureless silt with abundant AOM and one large round-wood 155cm; sharp to
163-185	Dark brown herb peat; gradual to
185-207	Mid-brown structureless silt with common small stones, abundant AOM, common fine fleshy stems, rare medium round-wood, rare small wood fragments and single <i>Corylus</i> (hazel) nut at 202cm; sharp to
207-229	Pale grey structureless clay with single large wood fragment 228-29cm; bottomed on stone

Borehole 2e	NS 68175 85752 (10.0m from southern edge of peat; 2.0m from northern edge)
<i>Depth (cm)</i>	<i>Description</i>
0-20	Not sampled: bottomed repeatedly on gravel