

THE KASTELHOLM PHOSPHATE SURVEY

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The phosphate survey is part of the archaeological research connected with the restauration of the Kastelholm castle. It aims to map the distribution of prehistoric and historic human activity within an area that has a rather complex settlement history.

A total of 1304 soil samples were collected with a borer following a rhombic grid of 30 m. The orientation of samples lines was determined by compass and the 30-m separation between sampling places with a pocket optical distance meter (m-100 Optimeter). Soil phosphate was determined according to Arrhenius' (1935) old method, slightly modified to suit the limitations of our field laboratory.

The soil samples were air-dried and made homogeneous with a 1-mm sieve. Four ml of the sieved material were scooped, placed in a labelled plastic bag and weighed. I used throwaway plastic bags for feeding babies, which are inexpensive, strong, sterile, and moderately heat resistant (Fig. 1). The samples were treated with 40 ml of 2 % citric

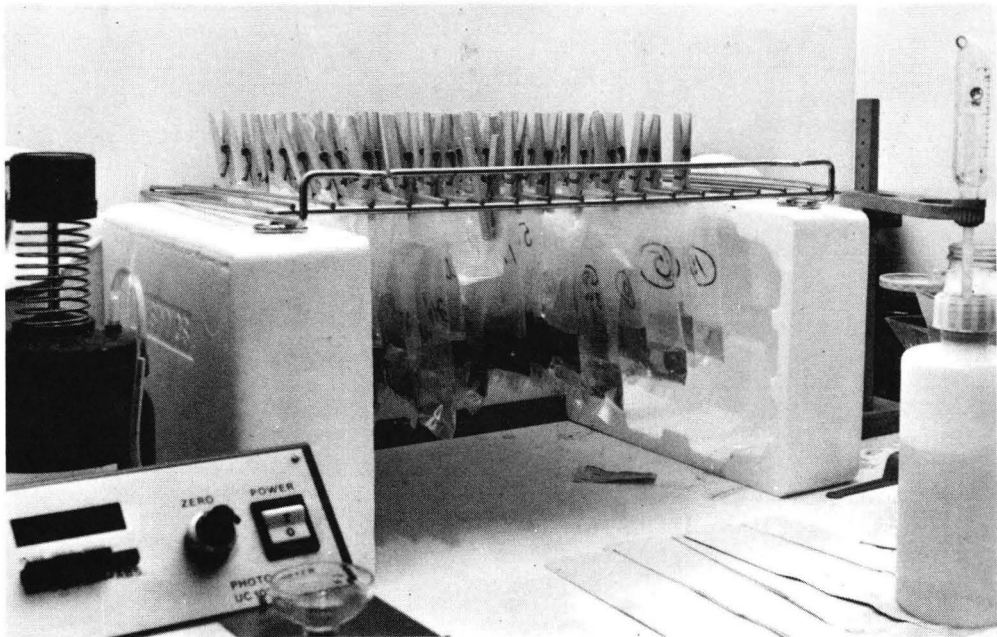
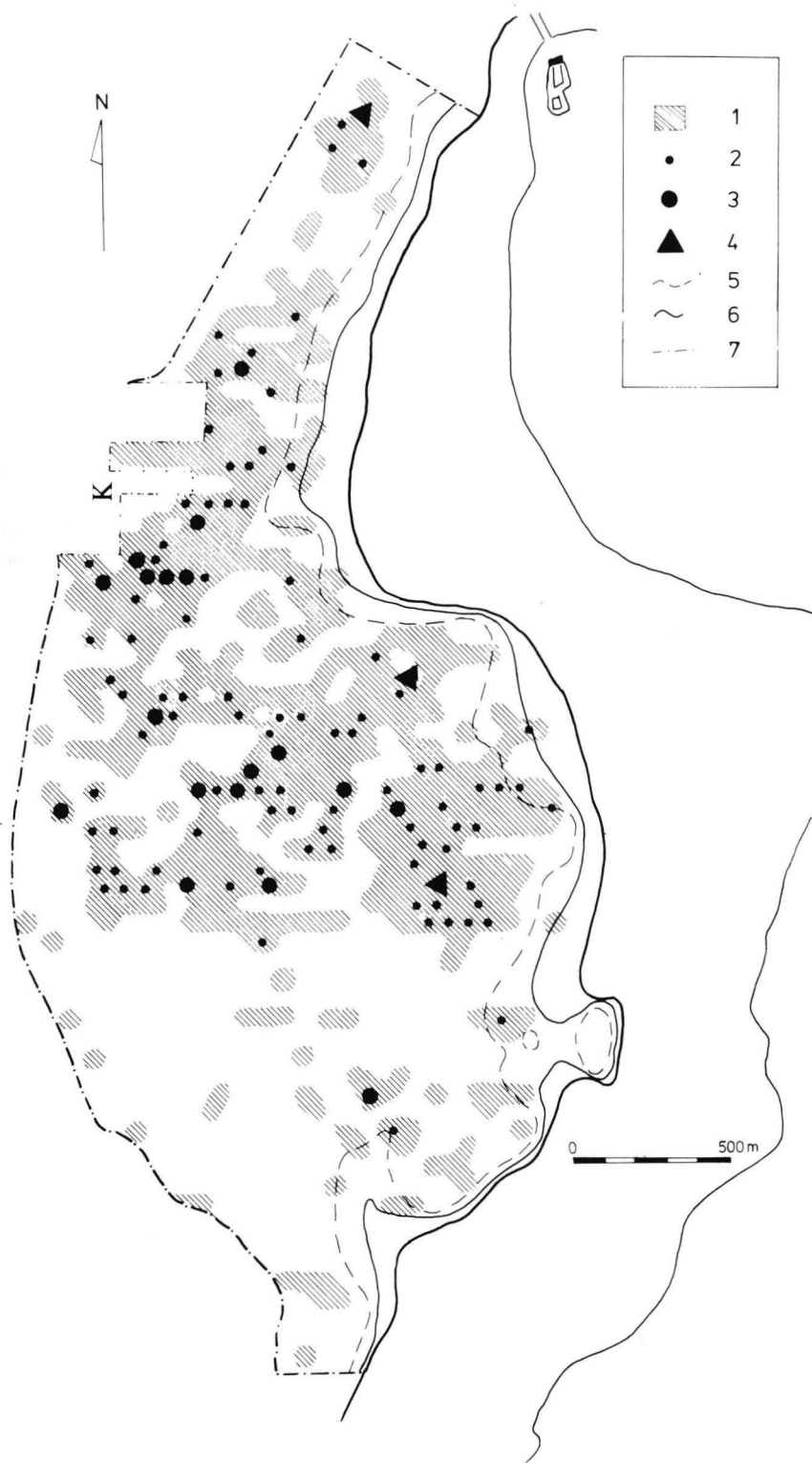


Fig. 1. A rack with plastic bags containing developing solution to be placed in the oven.



acid at 75°C for 2 hours and then let stand for 12 hours, after which they were filtered. Three ml of filtrate were placed in clean labelled bags and treated with acid ammonium molybdate-sodium sulphite developing solution (Nunez 1977) at 75°C for 2 hours. After one hour of cooling, phosphate was determined colorimetrically from the molybdenum-blue complex and the values calculated by weight as phosphate degrees (fosfat grader). The results have been summarized in the map of Fig. 2.

Relatively high soil phosphate (> 200 P°) tends to occur above the 1000 AD shoreline (c. 5 m a.s.l.), and practically all higher values are contained within the 1500 AD shoreline (c. 2.5 m a.s.l.). This suggests that it derives from the late Iron Age and the medieval settlement in the area. In general, the highest phosphate values seem to fall between 15 and 30 m above sea level (Table 1). This roughly corresponds to a plateau-like terrace formation found above c. 18 m a.s.l. During the late Iron Age settlement and fields would have lain on suitable points of this somewhat sandy »plateau«. The lower and clayier land would have offered excellent grazing. Old maps (1650, 1767, 1885) suggest that, with the exception of field area increasing at the expense of grazing land, the settlement pattern remained basically unchanged until the 20th century.

A comparison of the areas cultivated during the 17th–20th centuries against the distribution of soil phosphate suggests a negative correspondence. This feature, which I have observed at other sites in mainland Finland, is probably due to the continuous removal of phosphates by crops. Although manure provided the necessary nutrients, it apparently takes centuries before its phosphorus is fixed by the soil as the iron phosphates that citric acid preferentially dissolves.

Despite the occurrence of numerous outcrops in the study area, there was no indication of the so-called bedrock effect, which raises the phosphate content of the soil near the bedrock (Nunez 1977, 1978). This may be characteristic of the local bedrock, the rapakivi granite of Åland.

In 1985 we plan to expand the phosphate survey about one kilometre to the north, to include the castle and the medieval Sund church.

Table 1. Frequency and mean soil phosphate values with at various altitudes above sea level.

Metres A.S.L.	Frequency of phosphate degrees				Number of samples	Mean P
	<100 %	100–200 %	200–400 %	>500 %		
<2.5	58	33	6	3	88	106
2.5–5	30	43	22	5	103	154
5–10	29	41	24	6	210	161
10–15	16	34	40	10	164	198
15–20	9	28	48	15	169	227
20–25	18	24	37	21	177	222
25–40	33	37	23	7	277	158
40–56	84	21	9	2	116	86
0–56	30	33	28	9	1304	171

Fig. 2. The 1984 phosphate survey at Kastelholm: (1) Areas with over 200 P°; (2) places with 300–500 P°; (3) places with over 500 P°; (4) sites with late Iron Age graves and/or house foundations; (5) shoreline around 1000 AD; (6) shoreline around 1500 AD; (7) boundary of surveyed area, which is bounded on the east by the sea. One phosphate degree (P°) corresponds to 10 ppm of P₂O₅.

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