DETERMINATION OF SOIL PHOSPHORUS AROUND THE ARCHEOLOGICAL SITE IN SPURILA, PAIMIO

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The soil phosphate analyses as applied to archeological problems have been used for estimating the limits and the location of the settlement in Spurila, Paimio.

The phosphate analysis of the soil in connection with archeological investigation was first attempted in Sweden by Arrhenius (1931, 1934, 1935, 1938, 1950, 1955). The method has thereafter been used elsewhere in Scandinavia (Provan, 1971; Bakkevig, 1980) and also in Finland (Meinander, 1939; Carpelan, 1973; Ilvonen, 1974; Núnez, 1975, 1977, 1978; Matiskainen, 1982; Luoto, 1984).

In Paimio soil samples (309 in number) for phosphate analysis were taken by the archeologists in the summer 1983 from an area of about 70 ha situated at about 5—35 m a.s.l. The present rate of land uplifting is approximately 50 cm/100 years in this area.

The soil samples were taken using a N-S/E-W oriented grid system (Fig. 1), in which the distance between the sample spots was 40 m. Samples were collected from the habitation layer. In areas where a habitation layer could not be seen, the samples were taken from the enrichment zone of the soil profile.

In the laboratory the samples were dried in the oven, ground homogenous, sieved through a 2 mm sieve and stored for later analyses.

The extraction procedure adopted for phosphate determination was based on the method of Egnér et al. (1960) suitable for determinations of phosphates derived from human activity. The samples were extracted with 2N hydrochloric acid in boiling water-bath for two hours. The extracts were then filtered, diluted and the phosphorus content was determined with Metrohm E 1009 colorimeter.

The normal phosphorus content of the soils varies. The soil phosphorus originates from the phosphate minerals of the bedrock. The Finnish bedrock contains 0.11 % P_2O_5 (Sederholm, 1925). The most common source is apatite. In Paimio the bedrock itself consists of mainly kinzigite (Rankama, 1964) and does not account for high phosphate values.

High phosphate values around the settlement are derived mainly from urine and feaces of man and animals, from animal manure used as fertilizer, and from refuse (Cook and Heizer, 1965). Also the vegetation has its influence (Arrhenius, 1935).

The phosphates of the soil are either organic or inorganic. The change from organic to inorganic phosphate occurs very slowly in the soils of temperate region (Williams, 1967). During the change the phosphorus usually becomes mineralized and insoluble. Finnish soils are found to retain P all the more effectively the finer the soil material is (Kaila, 1965; Kurki, 1972; Hartikainen, 1979, 1982). However, in leaching the

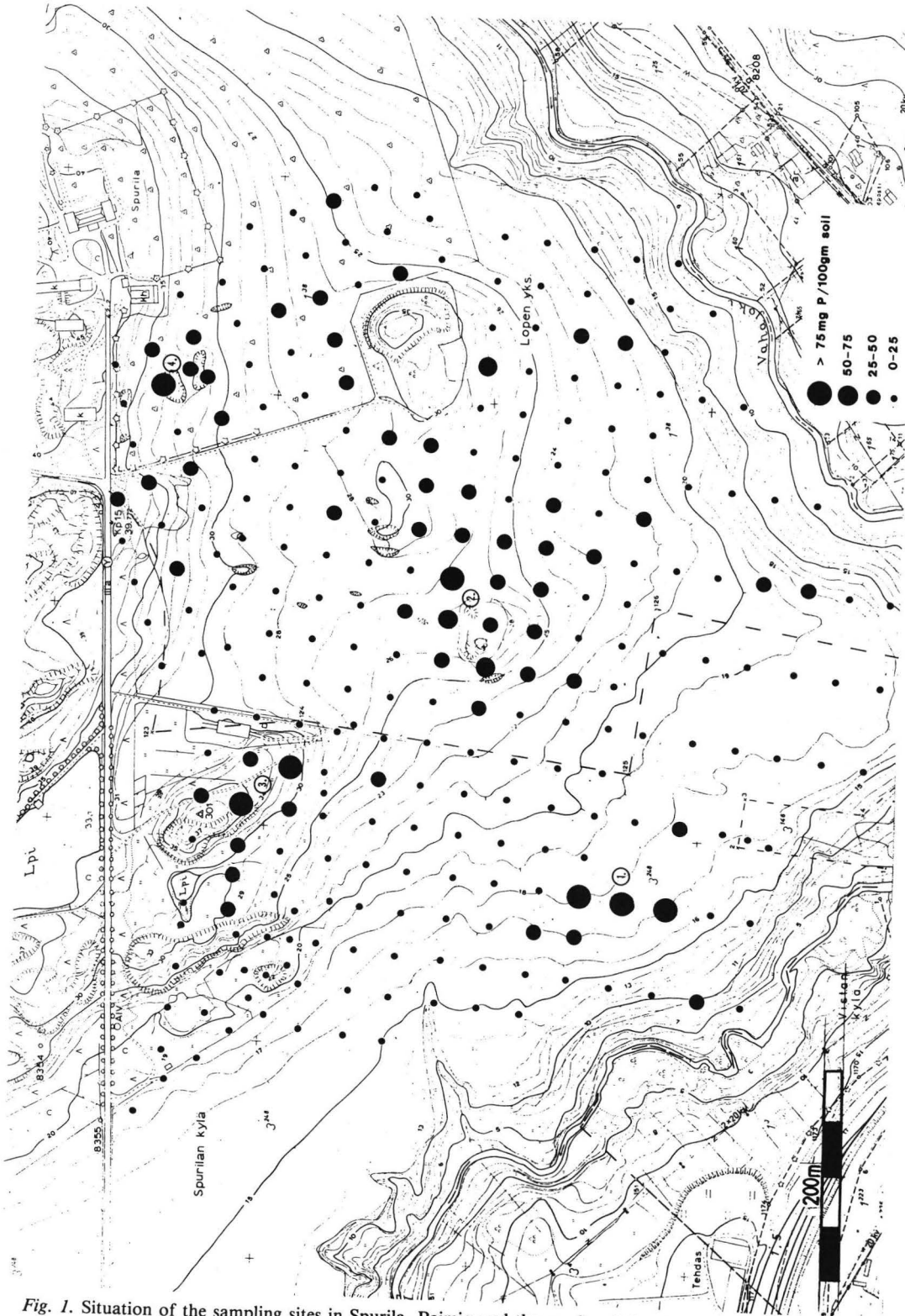

Fig. 1. Situation of the sampling sites in Spurila, Paimio and the results of the phosphate survey.

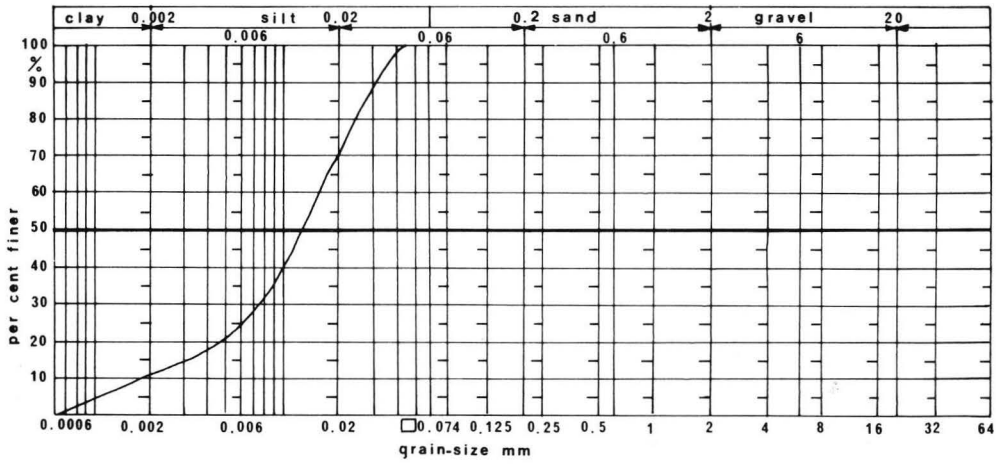

Fig. 2. The grain-sizes of the samples varied from clay to silt.

coarse-grained soils yield more phosphates than fine-grained ones. Thus the fraction of the soil samples has a strong effect on the results.

All the samples analysed in this investigation are from very fine-grained soils with grain-sizes varying from clay to silt (Fig. 2). The similarity of the grain-sizes makes it easier to compare the results with each other.

The phosphate enrichment in Stone Age sites is generally of higher order than in sites from later periods. This is presumably a result of a change in diet from one largely based on fish and game to one in which plants were more important (Arrhenius, 1935).

The results given indicate phosphorus in mg per 100 grams of dry soil (Fig. 1). Sample number was large in order to ensure the determination of the local phosphorus level ('local background') in the area. The P values obtained by different extraction methods cannot be compared directly with each other. The results of this investigation (extraction with 2N hydrochloric acid) are quite similar to values found in Norway in connection archeological investigations (Provan, 1971).

The results found in Paimio are arranged in Fig. 3 according to phosphorus concentration.

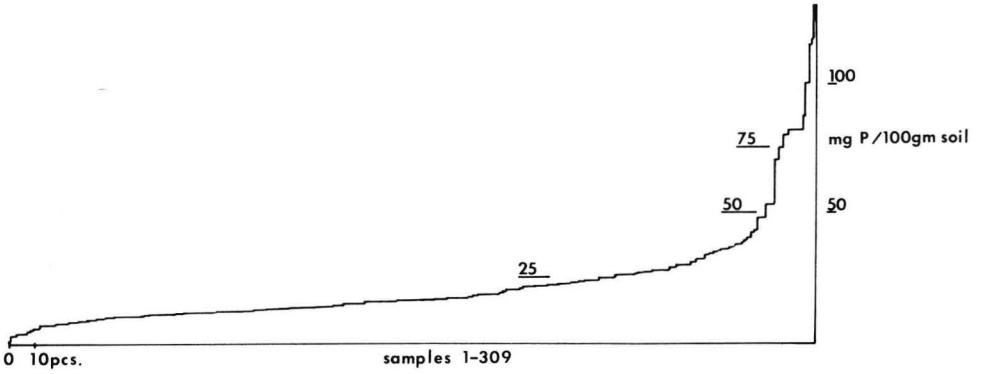

Fig. 3. The samples according to their phosphate content.

When the samples were analysed and results plotted on the map, four areas with high phosphate values were evident (ns. 1, 2, 3 and 4 in Fig. 1). The level of soil phosphate was usually 10—40 mg P/100 gm soil (with a mean 20 mg P/100 gm soil). The highest P-value was 130 mg and the lowest 0.75 mg P/100 gm soil.

The highest values (more than 100 mg P/100 gm soil) were found at 17—18 m a.s.l. in the southwestern part of the area (n. 1 in Fig. 1).

High values were also found at 25—35 m a.s.l. on hillsides (ns. 2, 3 and 4 in Fig. 1), where some archeological findings have now been made.

The four areas with high phosphate values invite for further archeological investigations. With denser grid in soil sampling more accurate information about the area could be obtained.

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