

A Soil Profile Containing Abnormally High Phosphoric Acid

by

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Introduction: During the soil survey of Tanjore district, it was noted that the soil profile taken in the village of Pattiswaran contained an abnormally high amount of phosphoric acid. A detailed investigation was carried out to find out the nature and cause of this unusual phenomenon.

Pattiswaram is situated about three miles south-west of Kumbakonam. A rapid test for phosphoric acid in the surface soils of the village was conducted with the Purdue kit and it was noticed that the soils with high phosphorus content are located round about the hamlet of Injaladi.

Materials and Methods: A profile pit was dug at Injaladi (S. No. 156) to the water table to a depth of about six feet and the soil horizons were studied in the field and samples collected for examination in the laboratory. The details of the soil profile are given at the end. Four surface-soil samples of 0 to 9" depth were also taken at distance of 200 yards south, west, north and east of the profile pit for analysis in the laboratory. Surface samples selected at random were tested on the spot for phosphoric acid to find out the extent of the area high in phosphoric acid.

Results: The results indicate that the high phosphorus content in the soil is localised round about Injaladi in an area of about 200 acres. The soils of the region are Cauvery alluvium. The results of the analysis of the soils samples from the profile pit given in table I indicate that the phosphorus content is high in the first and second foot with about 50% of the phosphorus in the available form. There is an abrupt change in the third foot, the total and available phosphorus being very low. However, in the fourth and fifth foot of the profile the amount of total and available phosphorus again increases to much higher values than in the top soil. The third foot sample differs to some extent from the others in its mechanical composition and other chemical constituents also.

Examination of the mechanical separates of the profile samples shows that the phosphorus is concentrated in the finer fractions (Table II). The finer fractions contain about three to

TABLE I
 Analysis of samples of the profile pit (as percentage on oven-dry basis)

Soil No. sample depth	Loss on igni- tion	In- solubles	Iron and alu- mina	Cal- cium oxide	Magne- sium oxide	K ₂ O	Total P ₂ O ₅	Avai- lable P ₂ O ₅	Nitro- gen carbon	pH	Mechanical composition				SiO ₂ R ₂ O ₃ of clay	
											Clay	Silt	Fine sand	Coarse sand		
1. 0-6"	4.23	82.9	9.99	1.07	1.14	0.44	0.241	0.131	0.111	0.837	7.50	26.4	8.8	27.2	38.3	2.79
2. 0-12"	2.98	84.6	9.83	1.26	0.97	0.41	0.248	0.113	0.056	0.315	7.80	26.6	8.8	24.7	41.8	2.95
3. 12-24"	2.80	83.4	10.84	1.16	1.17	0.48	0.360	0.214	0.033	0.243	7.80	28.2	9.7	25.8	37.2	2.84
4. 24-36"	4.77	77.1	15.96	0.90	0.72	0.36	0.065	0.007	0.019	0.099	7.80	42.6	16.8	32.0	10.5	2.34
5. 36-48"	3.05	83.2	10.97	1.56	1.67	0.40	1.024	0.417	0.029	0.205	7.40	27.7	10.3	25.7	36.8	2.90
6. 48-60"	3.48	82.0	8.42	1.45	1.61	0.50	0.801	0.183	0.029	0.206	7.70	28.6	10.6	50.4	11.6	2.69*

four times the phosphorus content of the coarser mechanical separates. The phosphorus-bearing material in the coarse fractions was separated by hand-picking and examined. It is greyish in colour and has a conglomerate structure. It is brittle and porous and gives effervescence with dilute hydrochloric acid. The data from chemical analysis of the material is given in table IV. From the chemical composition and from the examination of the material under the petrological microscope, it can be inferred that it is a secondary formation of carboxyapatite deposited over quartz and iron-bearing materials.

TABLE II
Phosphoric acid in the mechanical separates

Mechanical separate	Depth at which the sample was taken					
	0-6"	6-12"	12-24"	24-36"	36-48"	48-60"
Clay	0.584	0.565	0.847	0.142	1.35	0.946
Coarse fractions	0.179	0.203	0.221	0.034	0.379	0.269

TABLE III
Analysis of surface samples from the different corners of the hamlet

S. No.	Sample	Total P_2O_5	Available P_2O_5
1.	South	0.265	0.124
2.	East	0.173	0.017
3.	West	0.240	0.100
4.	North	0.123	0.020

TABLE IV
Analysis of phosphorus-containing material in percentages

1.	Loss on ignition (CO_2)	6.78
2.	Insoluble	54.45
3.	Fe_2O_3	7.94
4.	Al_2O_3	3.42
5.	CaO	12.84
6.	MgO	Traces
7.	P_2O_5	5.93
8.	P_2O_5 expressed as $Ca_3(PO_4)_2$	12.94

Discussion: The investigation reveals that the occurrence of the high amount of phosphorus is localised in about 200 acres of land round about Injaladi. It is not due to the occurrence of any phosphorus-containing minerals. It would appear that it is due to human agencies.

Arrhenius (1920) and Dauncey (1952) have explained the occurrence of high phosphorus content in the soils of certain Swedish farm lands and sites of ancient Roman settlements in England as being due to human settlements. The village of Pattiswaram is situated near the ancient Chola capitals of Kumbakonam and Palaiyur. It may be that the village especially the hamlet of Injaladi was the dumping ground for waste materials of Chola capitals. Since phosphorus is not mobile, it may have got deposited in the locality while the organic matter and nitrogen of the waste materials have been lost by decomposition and leaching. A more probable explanation of the high phosphorus content of the soils is that the site was the burial and cremation grounds of the Chola capitals. The high amount of phosphorus in the first and second foot of the soil may be due to cremation which is generally done on the surface and that in the fourth and fifth feet may be due to the remains of the burial of human bodies.

Summary and Conclusion: The occurrence of a high amount of phosphorus in the soils of Pattiswaram village was investigated. It was found that it is localised in the hamlet of Injaladi. Field survey, soil profile studies and laboratory examination of soil samples suggest that the high phosphorus content of the soils is probably due to human agencies, the site having been used as a burial and cremation ground a long time back.

REFERENCES

1. Dauncey, K. D. M. 1952. *Adv. of Sci.* 9—331.
2. Tanjore District Gazetteer, 1906.

APPENDIX

Profile description:

- 0—5" Dark bluish grey clay loam, heavily cracked.
- 6—12" Dark grey clay loam.
- 12—24" Greyish brown clay loam.
- 24—36" Brownish silty clay.
- 36—48" Greyish brown clay loam moist.
- 48—60" Brown clay loam-very moist.
- 60" Water table.

The demarcations of the horizons are indistinct.