"SINGLE VALUE" SOIL CONSTANTS: A STUDY OF THE SIGNIFICANCE OF CERTAIN SOIL CONSTANTS.

VI. ON THE CHANGES PRODUCED IN A SOIL BY EXPOSURE TO HIGH TEMPERATURES.

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(With One Text-figure.)

In Paper V of this series (1), an examination was made of results obtained by heating certain soils to various temperatures up to a maximum of 250°. An estimate was made of the accuracy obtainable in such measurements, and a discussion given of the nature of the changes taking place in the soil. In the present note, similar considerations are applied to results obtained by heating the soils to temperatures up to nearly 1000° in a furnace.

The four soils used in the earlier work (Numbers 15, 41, 46, 56) were heated in an electric furnace, which was run from the A.C. mains. Temperatures were measured by means of a platinum thermometer used with a calibrated metre bridge, and Hoare's tables (2) were used to correct the platinum temperatures to the centigrade scale. There was no thermostatic control on the furnace, but the temperature could be varied when necessary by adjusting a rheostat in series with the heating coil. The temperature fluctuations during an experiment were of the order of 10°.

The results are shown in Fig. 1. The points for temperatures below 250° are those already reported in Paper V, and the points for higher temperatures represent means of either duplicate or triplicate readings on samples heated together in the furnace. As might be expected from the more accurate temperature control in the Hearson oven used with the lower temperatures, the points derived from the earlier series of experiments lie much closer to the smooth curves than do those obtained at the higher temperatures. But these latter points are of interest, as they are obtained under conditions comparable as regards their degree of precision with those applying to ordinary laboratory measurements of loss on ignition. The range of temperature fluctuation is probably less

than that which occurs with a furnace specified merely as being at "red heat," "bright red heat," etc.

It will be seen that the curves in Fig. 1 rapidly tend to become parallel to the T-axis for temperatures above about 450°, where the change in direction of the curves is fairly sharp, and that there is hardly any significant increase in w as the temperature increases beyond 600°. If one very "bad" point (for soil No. 56 at 689°) be neglected, the general scattering of the points about the curves suggests that the errors are of the order of 1 per cent. of the true value of w.

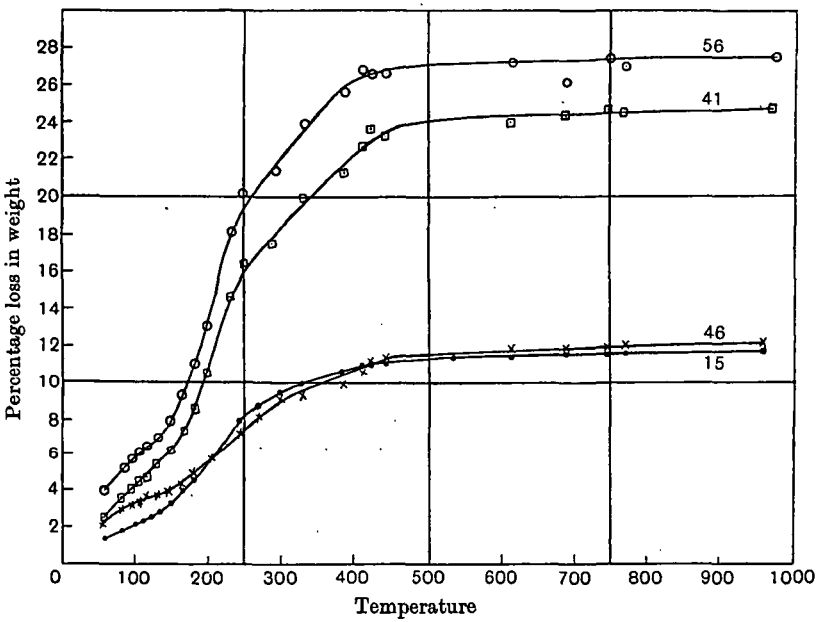

Fig. 1.

In the discussion of the results in Paper V, it was pointed out that there is (i) a sharp upward trend of the curves between about 130° and 170°; and (ii) an approximately rectilinear portion between 180° and 220°; and it was suggested that these features of the curves corresponded to (i) the removal of interstitial water *plus* organic colloids, and (ii) the removal of organic colloids alone. Inspection of Fig. 1 in this paper shows that there is another rectilinear portion of the curves between 250° and 400°. The portion is well marked in the case of the heavy soils Nos. 41 and 56, and less pronounced with the lighter soils Nos. 15 and 46. Continuing the earlier argument, it may be suggested that this section

represents the removal of inorganic colloids from the soil: while the subsequent "tailing off" of the curves corresponds to the destruction of surviving small quantities of hydrated silicates and aluminates. The theory has been put forward earlier that the inorganic colloids in soil are closely related to its clay content. If this be the case, there should be some correspondence between the loss in weight at temperatures above 250° (w_1) and the clay content (C). The ratio of w_1 to C is shown in the table.

Soil	15	41	46	56
w_1/C	0·258	0·172	0·196	0·211

Exact equality of the ratios could not be expected, on account of the complications arising from the influence of other soil factors, and also in view of the somewhat arbitrary choice of the temperature 250° to represent the break in the form of the curves. Under these conditions, the agreement in the three of the four cases appears to be satisfactory, but the figure for soil No. 15 is high as compared with the others. It may be noted in this connection that while No. 41 is derived from Ecca Shales, and Nos. 46 and 56 from Ecca Shales and Dolerites, No. 15 is from a Table Mountain Sandstone formation, in which the composition of the clay is probably different from that of the Ecca Shales soils.

Summary and conclusions.

1. Measurements on the loss of ignition of four soils of different physical type are not affected by changes in the temperature of furnace, provided that the temperature is above 600°. Errors in the determination of the loss on ignition are of the order of 1 per cent. of the true value.

2. The loss in weight of the soils can be ascribed in the main to loss of free and interstitial water up to about 100°; to destruction of organic colloids between 100° and 250°; and to destruction of inorganic colloids at higher temperatures.

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REFERENCES.

(1) Coutts, J. R. H. *J. Agric. Sci.* (1930), **20**, 541.
(2) Hoare, F. E. *J. Sci. Instr.* (1929), **6**, 99.

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