SUMMARY

A method for the quantitative determination of the inorganic elements in soils and their associated clay fraction using spectrographic techniques is described. The optimum spectrographic parameters, the useful range of analysis and the precision of the method was established. The method was used to determine the inorganic element content of a number of soils. The total soil and the clay fraction of the A, B, and C horizons of each soil were analyzed. Where they were not previously known, the clay minerals of the clay fraction were identified.

The soils used were Aura series on glaciofluvial gravel, Norton and Wethersfield on red shale, three unnamed Podzols on sandstone, Annandale series on gneissic plus carbonate rock, Squires series on calcareous drift, and two Montalto series on basic igneous rock. The distribution of trace elements in the profiles was determined and comparisons made between young and old soils on the same parent material and between soils of different parent materials weathered for equal lengths of time in the same climate. The type of clay mineral and the content of trace element was also noted.

The most important results were:

1. The development of a rapid, simultaneous and precise spectrographic method for the inorganic analysis

of soils and soil clays.

2. The wide variations in the physical characteristics and chemical composition of samples were overcome by chemical pre-treatment and suitable buffering.

3. The use of only two sets of standards from which to prepare curves that could be used for all soil types analyzed.

4. A study of the buffer procedure which determined the optimum spectrographic parameters, the useful range of analysis, and the precision for each element.

5. The determination of conditions necessary for quantitative precipitation of Fe and Al in the preconcentration method.

6. The simultaneous, quantitative determination of Al, Co, Cr, Cu, Fe, Ga, Mg, Mn, Ni, Pb, Sn, Ti, V, and Zn in a single 2.0 gm. sample of soil or 0.2 gm. sample of soil clay.

7. The positive identification and determination of Al in soil on a routine basis.

8. The determination of Mg in soil without interference by Ca and with better precision than that obtained for colorimetric procedures.

9. The use of the Zn 3345 spectral line instead of the Zn 3282 spectral line due to the high content of Ti in the soil.

10. The favorable comparison of spectrochemical and classical chemical results on N.B.S. standard deposit clays.

11. The methods were used on ten different soils without any modification despite the wide variation in soil types.

12. The distribution of trace elements in the profile of ten different soils was established, both for the total soil content and the clay fraction content.

13. There were no outstanding differences in the trace element content or distribution between soil formed on the same parent material but of different age, either for the total trace element content or the content of the clay fraction.

14. Soils formed on different parent materials and subjected to the same weathering sequence did show differences.

15. A study of the influence of the type of clay mineral on the distribution of trace elements between the clay fraction and the total soil showed that parent material was of greater importance than clay mineral type.