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"THE RELATIVE SIGNIFICANCE OF
IRON - BINDING AND ALUMINIUM - BINDING
OF PHOSPHATE IN SOILS REPRESENTATIVE
OF THE MAIN NEW ZEALAND GENETIC
GROUPINGS AS REVEALED BY
FRACTIONATION METHODS AND BY
PHOSPHATE FIXATION STUDIES IN
THE LABORATORY."

by

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I.

A. INTRODUCTION

Although a great body of evidence points to the presence of iron - and aluminium - bound phosphate in soils as products of the phosphate fixation process, until recently no satisfactory procedures have been available for the quantitative assessment of the amounts of these forms in soils.

Chang and Jackson (1957) were the first workers to propose a scheme of phosphate fractionation, which included the separate determination of iron - and aluminium - bound phosphates. The limitations of their procedure have been discussed by Fife (1959a, 1959b and 1962), who has proposed (1962) a modified method for the determination of the aluminium - bound soil phosphate fraction. Fife (unpublished results) has subsequently incorporated this procedure into a general scheme of soil phosphate fractionation, which includes the selective determination of iron - bound and calcium - bound phosphates.

The iron - and aluminium - bound forms of phosphate in soils are of secondary origin derived in the case of virgin soils from original apatite and in the case of fertilized soils by fixation of applied phosphate. Their proportionate incidence in any given soil is a reflection of the relative tendency for iron and aluminium compounds to fix phosphate derived by weathering of apatite or from added phosphate fertilizers. It was considered of interest to investigate whether the ratio of iron - bound to aluminium - bound phosphate in a range of New Zealand soils followed any pattern which could be linked with the established genetic classification of these soils. It was further considered of interest to investigate whether a relationship existed between the ratio of these forms found in field soils and that found by laboratory fixation studies.

Any laboratory study of the relative contribution of iron and aluminium compounds to the phosphate fixation process demands a procedure for the removal of one of these compounds so that the phosphate retaining properties of the other may be investigated. Ideally the fixing capacity should be studied

- (a) after dealumination,
- (b) after deferration,

and the summation of these quantities compared with the phosphate fixing capacity of the whole soil, steps being taken in all cases to ensure that alkaline earth cations, which may fix phosphate by precipitation reactions, are first removed from the systems.

Unfortunately there appears to be no procedure whereby iron oxides can be removed from soils without simultaneous removal of aluminium. Fife (unpublished data) has, however, concluded that prolonged treatment of soils with 0.5 M NH_4F at pH 8.5 should completely eliminate aluminium - binding of phosphate by virtue of the ability of this reagent to form complex ions with aluminium but not with iron at this pH value. Soils dealuminated in this way should therefore serve for studies on phosphate retention by free iron oxides. Strongly alkaline solutions such as 1 M NaOH may also be expected to achieve dealumination through the formation of soluble aluminates. Both these methods were investigated in the present study.