Fusion with Sodium Carbonate for Total Elemental Analysis

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63-1 INTRODUCTION

The total elemental analysis of soils or specific fractions of soils requires the conversion of insoluble materials to soluble forms by special methods of decomposition. The most convenient method is that of fusion with various fluxes. Anhydrous sodium carbonate (Na₂CO₃) has been the most useful flux for soil and its separates. Aside from a few resistant minerals, for which fusion with other fluxes is necessary, practically all common soil constituents are decomposed by a Na₂CO₃ fusion. After the fusion, the melted cake can be analyzed for Si, Al, Fe, Ti, Ca, Mg, and Mn, which, together with Na, K, and P, comprise what is often referred to as the “main portion” of an elemental analysis of a soil. The melt can also be used for the determination of several other elements which occur in trace amounts.

Textbooks by Groves (1951), Hillebrand et al. (1953), and Washington (1930) contain detailed procedures for Na₂CO₃ fusion analyses of rocks and minerals. Jackson (1958), Piper (1944), and Robinson (1945) describe the use of Na₂CO₃ fusion for the decomposition of soil and its separates.

Since adsorbed water, water of constitution, and organic matter are important constituents of a soil, it is necessary to take them into account in making a total analysis of a soil. The Na₂CO₃ fusion may therefore be performed on a soil sample after it has been oven-dried for the determination of adsorbed water, and also after it has been ignited for the determination of water of constitution and organic matter (collectively referred to as loss on ignition).

63-2 PRINCIPLES

The method used in the Na₂CO₃ fusion analysis of soils is one designed originally for analysis of silicate rocks and minerals. The chemistry of a Na₂CO₃ fusion in soils is therefore based largely on the decomposition of