

Alteration. These primary rocks are very slightly altered. Much of the feldspar is kaolinized, but not to any great extent, and a large amount of clear glassy sanidine and orthoclase is found. Ægirite-augite is usually quite unaltered, though some of it is changed to chlorite. The analcite is slightly changed in some specimens, and a replacement of this mineral by calcite occurs in varying degrees up to completion. Alteration of melanite has not been observed. Such changes as have taken place are those characteristic of the zones of weathering and oxidation, and no secondary minerals characteristic of the deeper zones are present.

SECONDARY ROCK TYPES. (PYROCLASTICS).

Preliminary Statement.

The scope of the present paper does not admit of a detailed description of the many varieties of agglomerate and tuff studied in thin section. Certain types are peculiar, or are repeatedly found, and these merit a word of description.

The lithologic terms used here in describing the pyroclastic rocks should perhaps be defined, as there seems to be some disagreement as to the exact meaning of the words tuff, agglomerate, and breccia. *Tuff* in this paper denotes a stratified deposit of the finer volcanic ejecta, of the general size of grain of sandstones. The coarser varieties are termed *agglomerates*. *Breccia* is used only to mean "broken rock," as it is a term of too general application to be applied to a single class of deposits without some qualifying adjective. Even in the latter case it is not necessarily definitive, as a wide variety of pyroclastic rocks, of differing textures and origins, may properly be spoken of as volcanic breccias.

As in the case of sandstones and conglomerates, there is an intimate gradation between tuffs and agglomerates, and the varying proportions of fragments of different sizes precludes the possibility of rigid definition. In this paper, stratified pyroclastic rocks having fifty per cent or more of their fragments great than six millimetres (one-fourth inch) are termed *agglom-*