
Chlorite Vermiculitization and Pyroxene Etching in an Aeolian Periglacial Sand Dune, Allen County, Indiana

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Abstract: Weathering has etched and deeply-denticulated the constituent orthopyroxenes, and chlorite has been transformed to vermiculite in the upper 3 m of an aeolian, periglacial sand dune formed in northeastern Indiana about 13,000 b.p. Pyroxene weathering begins with the development of cleavage-parallel etch pits on {010} and {100} surfaces. These pits coalesce and eventually crop out on basal surfaces as denticulations. The mean denticulation size increases logarithmically toward the surface, and the denticulation size of the orthopyroxenes is a quantifiable feature of the weathering process. Ferruginous pendants, microboxworks of iron oxides, and other indications of iron redeposition within the orthopyroxene microenvironments were not observed.

Chlorite in the dune has been weathered to vermiculite. The parent chlorite is a high-Fe variety, and the transformation to vermiculite does not involve the development of a chlorite/vermiculite intermediary phase. Fe^{2+} is oxidized as part of the transformation process and this iron is retained in the sediment as discrete goethite and as crystalline and noncrystalline coatings on the dune grains. The vermiculite from depths shallower than 64 cm is only partly expandable and is completely collapsed by K-saturation or heat treatment. This is a hydroxy-Al vermiculite and its formation is typical of intense weathering under the acid conditions prevalent at the dune surface.

Key Words: Chlorite • Denticulations • Dunes • Etching • Hydroxy-Al • Indiana • Pleistocene • Pyroxene • Vermiculite • Weathering

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