The Petrography of Ancient Organic Matter in Black Shale Weathering Profiles

Lehne E. Slater and S. M. Rimmer
Department of Earth and Environmental Sciences, University of Kentucky, Lexington, KY 40506-0053

Global atmospheric O_2 content is influenced greatly by the weathering of ancient organic matter (OM). Presently, efforts to understand the controls on ancient OM weathering have focused primarily on geochemistry and have concluded that variation in OM type is not a significant control on black shale weathering, but rather physical erosion and oxidation are the controlling factors. In this study, relative weathering rate and efficiency of ancient OM was determined by studying kerogen petrography in addition to geochemical and isotopic composition. The weathering profile studied (New Albany Shale, eastcentral Kentucky) contains Type II kerogen, which is a mix of labile marine alginite and bituminite and more recalcitrant terrestrial vitrinite and inertinite. Samples were collected along a horizontal stratigraphic layer at increasing depths into the weathering profile so that weathered and unweathered shale could be compared.

Petrographic results show that bituminite and alginite are most abundant in unweathered shale and decrease by as much as 99% as weathering increases. In contrast, abundance of vitrinite and inertinite is lowest in the unweathered portion of the profile and significantly increases as weathering increases. Measurements of weight percent C of individual macerals show that grams of both recalcitrant and labile macerals decrease with increased weathering, but recalcitrant macerals did not decrease as much as labile macerals. Bituminite and alginite were removed from the profile more easily during weathering than vitrinite and inertinite. These results suggest that OM type does play an important role in determining the rate and efficiency of black shale weathering.