

MANGANESE OXIDES OF THE TERRESTRIAL WEATHERING ENVIRONMENT

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Manganese oxides occur in the terrestrial weathering environment in desert varnish, manganese dendrites, soil concretions, and in deposits associated with rivers, glaciers, and caves. In most cases the oxides are intimately mixed with clay minerals or the material of the rock substrate. They are frequently characterized by small particle size or poor crystalline order. Infrared spectroscopy is thus a useful tool for determining their mineralogy. We have found that the morphological differences which distinguish the various types of deposit are paralleled by mineralogical differences. Birnessite is the only manganese oxide found in desert varnish, and it is invariably associated with hematite and large amounts of clay minerals. Either romanechite (psilomelane) or hollandite is the manganese oxide in manganese dendrites. These may be found pure or mixed with small amount of clay minerals. Birnessite is the only manganese oxide found in river deposits. It is pure or mixed with small amounts of clay when deposited within the stream, but the clay content becomes large in splash zone deposits. Cave deposits appear similar to river deposits in both morphology and mineralogy. Uncontaminated birnessite was found for one glacial deposit. Others are similar to varnish in appearance and mineralogy. Soil concretions contain a wide range of manganese oxide minerals. Both organic material and simple polishing of the rock surface can be mistaken for manganese oxide deposits. Birnessite, hollandite, and romanechite rather than pyrolusite are the most common manganese oxide minerals of the terrestrial weathering environment.