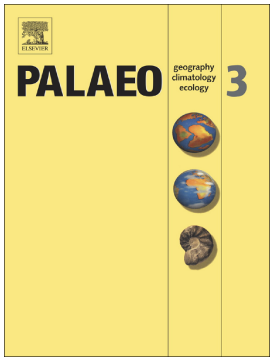

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Influence of palaeoweathering on trace metal concentrations and environmental proxies in black shales

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Abstract

The mineralogical and chemical compositions of Lower Carboniferous (Tournaisian) marine black shale from the Kowala quarry, the Holy Cross Mountains, Poland were investigated. This study focuses on disturbances in palaeoenvironmental proxies caused by palaeoweathering, which progressively changed the major and trace element abundances. Palaeomagnetic investigations reveal that the Devonian – Carboniferous succession was weathered during the Permian-Triassic by the infiltration of oxidizing fluids related to karstification following post-Variscan exhumation. The weathering process led to vermiculitization of chlorite, partial dissolution of calcite and replacement of pyrite by hematite and goethite. Moreover, the concentrations of some trace metals, including Co, Cu, Pb, Mo, Ni, As and U, significantly decreased. Consequently, some elemental abundance ratios that are used as environmental proxies, including U/Th, Ni/Co and V/Cr, were altered. Elements that are bound to iron sulphides (e.g., Mo) appear to be especially prone to mobilization by even a lightly weathered black shale. The documented weathering, including changes in elemental concentrations, can create misinterpretations of the original palaeoenvironmental conditions. In addition, the palaeoweathering of the studied samples appears to have substantially changed the carbon, oxygen, nitrogen and molybdenum stable isotope values. The nitrogen and molybdenum stable isotope ratios, in particular, appear to be most sensitive to the effects of weathering and therefore are good indicators