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This study was focused on the paleoclimate and paleoenvironmental reconstruction of the bauxites formed during the early Kimmeridgian to the late Tithonian emersion phase in the succession of the Western Istrian anticline. They are especially interesting because they contain three types of bauxites: red bauxite, grey bauxite, and white bauxite. Their footwall consists of porous limestones of the Muča unit, and they are capped with the cyclic alternation of clays, marls, emersion breccias and schizohaline limestones, which are gradually replaced with the marine limestones of the Kirmenjak unit, as the transgression progressed. The emphasis of this study was on the mineralogy of the bauxite, and the overlying clays, especially. Mineralogical analysis was principally based on the XRD measurements of the bulk samples and <2μm fraction. We also wanted to relate the differences and trends of trace and rare earth elements with the mineralogy of clays and other phases in the bauxite. For this purpose, several samples of bauxite were selected for the XRF and ICP-MS analysis. The red bauxite is principally composed from hematite, boehmite and kaolinite, with variable amounts of dioctahedral chlorite, illite, rutile, anatase and goethite. The grey bauxite has a similar composition, but with pyrite instead of hematite. The white bauxite is devoid of iron minerals. Trace elemental patterns are concordant with the absence or presence of different iron phases. Rare earth elements seem to be fractionated differently in different sections of the bauxite body, with the enrichment in heavy rare earth elements and a positive cerium anomaly in the topmost section, and the enrichment in middle and light rare earth elements in the lower sections of the profile. This is likely a consequence of increased leaching of the topmost section of the bauxite during its formation, which is confirmed with higher concentrations of immobile components in the upper section, such as Al_2O_3, TiO_2 and lower concentrations of leachable SiO_2. Although there were no significant differences in clay mineralogy between different bauxite types, the clay mineralogy of overlying clays differs significantly from that of the bauxites. The clay beds overlying the bauxite are composed from dioctahedral vermiculite, kaolinite, illite and a mixed-layer clay mineral (MLCM) consisting of illite and dioctahedral 14 Å phyllosilicate. They display an apparent gradual increase in illite, with respect to kaolinite, towards the upper sections of the profile. This most likely signifies a progressive climate change towards a more temperate climate, as the weathering mode on land gradually shifted from monosialitization towards bisialitization. A certain portion of illite and MLCM could have originated from the fixation of K^+ from more potassium-rich marine waters. This coincides well with the blue-hole sequence model which has been proposed for the mode of transgression that followed the deposition of bauxite, as this leads to more increased marine influence as the transgression progresses.