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Origin of clayey materials deposited during Aptian/Albian emersion in Istria, Croatia

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The subject of this study are clayey materials deposited during Late Aptian / Early Albian long-lasting emersion phase in Istria (period of 11-19 million years). When they show indication of subaerial exposure and pedogenesis they are considered paleosols. The goal was to estimate the provenance of clayey materials. Investigations were based on detailed sedimentological, geochemical, and mineralogical analyses of clayey materials and undissolved limestone residue from the bottom of clayey horizons. Considering isolation of Adriatic carbonate platform during Aptian/Albian, there are three possible sources of material forming investigated clayey materials: (1) undissolved limestone residue; (2) volcanic material; and (3) aeolian material. Signs of vadose zone (geopetal structure, crystal silt) and small depths of palaeokarstification in limestone, as well as, low weight content of indissoluble limestone residue indicate small contribution of undissolved limestone residue in formation of investigated clayey materials. There are signs (immobile chemical elements proportions; negative europium anomaly; fragments of pyroclasts with altered volcanic glass; zircon, feldspars, pyroxene and amphibole grains in sand fraction; smectite in undissolved limestone residue) of volcanic material contribution in formation of clayey materials. Volcanic material probably came after resedimentation because during Aptian and Albian there is no known calcium-alkaline volcanism in neighbouring areas. Irregular and rounded forms of volcanic minerals in clayey materials are also in favour of resedimentation. Aeolian dust is probably the most important component of source material. Significant atmospheric circulation and accumulation of great amount of aeolian material during Aptian and Albian due to arid climate on the land; domination of smectite (formed by alteration of great amount of volcanic material widespread due to strong volcanic activity and formed by authigenesis in soils as a consequence of hot climate with contrasted seasons); very fine grain size of investigated clayey matrix which could enable long transport; and presence of metamorphous minerals (tourmaline, garnet) are indications of aeolian origin.