

GEOCHEMISTRY OF RED CLAYS IN THE EASTERN ALPS: REMNANTS OF LATE MIOCENE SOILS ?

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Red clays are found in the eastern part of the Eastern Alps on top of paleosurfaces and Tertiary basin remnants. These red clays did not form under present or Pleistocene climatic conditions and thus represent pre-Pleistocene remnants of soil. The occurrence of red clays, in turn, indicates the presence of a preserved paleosurface. The different red clay occurrences, however, did not necessarily form during the same period of time. Since the geochemical composition of the red clays is influenced by their substratum, paleoclimatic implications are limited. The substratum is both low and high grade metamorphic rock and Mesozoic carbonate rock.

The clay mineral composition of red clays from the Northern Calcareous Alps is quite homogeneous and dominated by vermiculite, illite and chlorite, with kaolinite as subordinate component. These clay minerals are not derived from the residuum of dissolved carbonate but from remnants of the siliciclastic Augenstein formation deposited on top of the Northern Calcareous Alps during late Oligocene to early Miocene times. Since the Augenstein formation was supplied from low grade metamorphic terrains, chlorite represents a residuum of the substratum. Vermiculite is assumed to derive from the degradation of chlorite. Illite typically forms under humid climatic conditions from sheet silicate minerals.

Red clays from the central-eastern part of the Eastern Alpine crystalline substratum are more variable. Illite and chlorite are always present, but mainly as subordinate components. Kaolinite is always a major component, in two cases by far the dominant component. One of the latter samples is taken from a Paleocene-Eocene section of a Gosau basin, representing fully tropical weathering conditions. It is therefore suggested that the undated red clays of similar composition also formed during this period. The relative importance of kaolinite, in contrast to the red clays from the Northern Calcareous Alps, is assumed to result from the feldspar-rich substratum. Smectite is present in very minor quantities except one sample, in which smectite is the most important component. For this sample, in-situ weathering of middle Miocene ash from the Styrian volcanic province is assumed.

The major element composition of red clays from the Northern Calcareous Alps displays high Mg/Ti and K/Ti ratios as compared to samples from the East Alpine intramontane basin of Oberwölz, the Swiss Jura Mountains and the Swabian Alb, which reflect the Mg- and K-rich clay mineral composition. The minor element composition displays high Ba/ Sr and Rb/ Sr ratios with respect to the reference samples, indicating stronger leaching of Sr due to enhanced precipitation. In turn, Fe enrichment in the reference samples reflects less hydrolysis and enhanced oxidation.