Mineralogical and Geochemical Study of Clay Mineral Transformations in the Sedimentary Triassic Jura Basin (France)

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Abstract: A detailed study of sediments from the Triassic of the French Jura shows that clay minerals vary continuously with the facies. Near the coasts of the Jura Sea, sediments consisted of sandy, continental detritus and the minerals are poorly crystallized. At the center of the basin, in what was a cation-rich chemical environment, they are well crystallized. A progressive mineralogical variation can be observed from degraded illite to well-crystallized chlorites passing through the intermediate stages of more-or-less regular mixed-layer structures. This variation is due to a true crystalline transformation.

Similarly, chemical variations in clay minerals and whole-rock samples are related to the paleogeography of the basin. The distribution of major and trace elements is a function of distance from the Jura Sea coastline and also a function of the mineralogical composition of the fine fraction. The most obvious relationships are: (1) An increase in the concentration of MgO and the percentage of ignition-loss water from the coast toward the deep sea; (2) A decrease in the concentration of SiO_2, Al_2O_3, and TiO_2 as well as that of trace elements such as vanadium, gallium, and cobalt from the coastal regions to the center of the basin; (3) A lack of statistically significant variations in the concentration of Fe_2O_3, Mn_3O_4, B, and Ni throughout the basin.

The authors conclude that: (1) Transformations (aggradations) observed by means of X-ray diffraction methods are in agreement with the chemical analyses; (2) Transformations are contemporaneous with the sedimentation; they are not diagenetic; (3) Clay minerals play an important role in the geochemical balance of sedimentary basins.

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