High resolution elemental analysis of Cretaceous black shale from SE France by non-destructive XRF scanner, TATSCAN

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Ultra high-resolution elemental variations for the lower Aptian black shale, Goguel level (Ocean Anoxic Events: OAE Ia), of the Vocontian Basin (SE France) is analyzed by using a new tool for non-destructive X-ray fluorescence (XRF) elemental scanner, TATSCAN. The TATSCAN has designed and developed to analyze 2-dimensional spatial distribution on the surface on the sediment and sedimentary rocks within a resolution of several micrometers in measurement diameter. Continuous sedimentary section of Gugel level is collected by using engine diamond-blade cutter from Les Sauzeries in SE France. The carbon isotope of organic matter in Goguel level shows obvious 6 per mil negative shift in the lower part of the section, obtaining that the section corresponds to global OAE Ia event. Six clear laminated intervals are observed in the section. The lamina consists of foraminifer-rich layer and clay rich layer. Carbonate contents increased in laminated intervals representing high occurrence of foraminifer lamina. Nanoconus occurrence increases in laminated intervals. Phosphorus nodules are often found in laminated shales. Color of the sediment becomes very dark not only laminated shales but also massive or bioturbated marls in the section. Organic carbon and iron sulfide contents increase in these intervals. Although ratio of silica versus aluminum shows almost constant values throughout the section, it increase in a particular laminated intervals, obtaining biogenic silica deposition. By ultra high-resolution elemental analyses by non-destructive XRF scanner, TATSCAN, revealed sedimentary processes of the black shale. Anoxic condition resulted from stagnation of water column is settled up in the first stage of black shale deposition. In that situation, depth of redox bounrary in the water column should change quasi-periodically. Downward shift of the boundary with nutrient-rich surface layer results in dark, organic rich, laminated shale deposition with surface water biogenic production of carbonate and silica. Upward shift of the boundary results in dark, organic rich, massive marl deposition. In the current statement, primary producer in these intervals is unknown. Development of bacterial consortium near redox-boundary or sediment surface may be one of source for organic matter in dark massive marl.