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Sedimentological and diagenetic studies in Early Cretaceous carbonates as indicators of environmental change: the prelude of the early Aptian Oceanic Anoxic Event (OAE1a)

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The early Aptian ($\sim$ 120 Ma) Oceanic Anoxic Event (OAE1a) is the first major Cretaceous event that was clearly global in its effect. It was associated with global distribution of organic-rich deposits, extreme greenhouse conditions, and significant changes in the ocean-climate system.

The Aptian carbonate platform of La Florida, in the northwestern Basque-Cantabrian basin (Cantabria, Spain), was deposited on the footwall of a tilted block formed during continental rifting related to the opening of the Bay of Biscay. The area has undergone only minor deformation since basin formation. It exhibits a well-exposed, continuous succession of shallow-water platform carbonates that includes an unit of early Aptian (*D. deshayesi* ammonites Zone; *Palorbitolina lenticularis* foraminiferal Zone) organic-rich marls with ammonites and belemnites, which are thought to represent the local sedimentary expression of the OAE1a. Facies analysis and early diagenesis studies of the limestones below the marly interval have been used as an approach to recognize environmental changes that prelude the anoxic event. We have distinguished two major stages of platform carbonates separated by a dissolution surface. Although in both cases the carbonate production took place in shallow water, they show, however, a marked compositional change in the type of carbonate production. The first phase of carbonate production is dominated by carbonate mud with photozoan-type communities dominated by rudist, hermatypic corals, dasycladacea algae, miliolids

and associated deposits. The second phase of carbonate production is characterized by an incipient hardground with development of iron oxides and encrusting foraminifera in the most inner shelf areas and by cross-bedded calcarenites towards more open shelf areas. The calcarenites are grainstone to rudstone dominated by a mesotrophic, heterozoan-like particle association made of benthic foraminifera, molluscs, echinoderms, and variable amounts of other skeletal grains (green and red algae, bryozoans), quartz sand/silt grains, reworked lithoclasts and ferruginous oolites and oolitic envelops. Early fresh-water dissolution and meteoric cementation characterize the lower unit below the dissolution surface but is even more extensive in the upper calcarenite unit.

We suggest that this compositional change documents conditions of environmental stress caused by changing nutrient concentrations and paleohydrological perturbations that preceded the anoxic event. Under extreme greenhouse conditions a more active hydrological cycle existed, which increased the rate of mean precipitation and continental runoff. Changes in the pattern of these two factors caused: 1) a perturbation in nutrient supply/source to the platform that induced the suppression of the photozoan-dominated carbonate production, 2) changes in salinity and sea-surface temperature that may have been an important factor in driving oceanic circulation changes, and 3) distribution of early meteoric diagenetic features favoured by the freshwater input into the platform in the states that preceded the OAE.