Increasing environmental stress along the Kellwasser crisis in the Catalonian Coastal Ranges: A geochemical and palynological approach

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The Frasnian-Famennian boundary has been recorded in the Catalonian Coastal Ranges (CCR) within a sequence of black shales, quartzarenites and radiolarian-rich chert deposited in a coastal sedimentary environment. This sequence has been dated as latest Frasnian (uppermost *rhenana-linguiformis* conodont zones) based on palynomorphs. Geochemical data of black shales record a rising environmental stress manifested in three succeeding pulses. High P_2O_5 and moderate TOC values, along with other inorganic proxies suggest for the lowermost pulse disoxic environmental conditions linked to high organic productivity. The second pulse has recorded low intensity hydrothermal activity in the black shales as suggested by the anomalous values of chalcophile elements (i.e. As, Hg, Sb, Co, Ni, Pb and Cu) with no evidence of anoxia. The uppermost pulse is characterized by strong anoxic, but not euxinic, conditions, some hydrothermal input and changes in the weathering regime. Anoxia is suggested by TOC values up to 13 wt% and positive anomalies of the main inorganic proxies for anoxia including: U_{EF}, Mo_{EF} and Re. Hydrothermal input is recorded as high Pb, As and Hg values. Variations in the weathering regime are also indicated by changes in Al-normalized major elements (i.e., Ca, Na, K and Mg) and some traces (i.e., Zr, Hf, Nb) at Ti/Al constant. Considering all the geochemical data, a strong case exists that this last pulse represents the Upper Kellwasser event, and that the co-occurrence of different environmental agents is the final cause promoting this event in the CCR.