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Depositional trends in the Valdorbia Section (Central Italy) during the Early Jurassic, as revealed by micropaleontology, sedimentology and geochemistry

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ABSTRACT

In the Umbria-Marche basin open marine Jurassic sediments are well exposed in the Valdorbia section (ENE of Gubbio, Central Italy). The time interval considered here is from the Carixian to the Early Aalenian. The depositional units, already dated by means of ammonites and calcareous nannofossils, are: limestones and cherty limestones, Pliensbachian in age ("Corniola" = COR); marls of Early – Middle Toarcian age ("Marne del Monte Serrone" = MS), including black shales in the Tenuicostatum Zone; reddish nodular calcareous marls and limestones, Middle Toarcian to Early Aalenian in age, which constitute the "Rosso Ammonitico Umbro-Marchigiano" (= RAUM); and bivalve-bearing cherty limestones, Aalenian in age ("Calcari a Posidonia" = CP). Micropaleontological, sedimentological, trace fossil and geochemical-mineralogical analyses have been carried out. The microfossil study has revealed changes in the microforaminiferal assemblages, corresponding to changes in both oxygen conditions and depth of the sea floor: Miliolina, Textulariina and Lagenina are common in the Carixian; Textulariina and Lagenina in the Domerian and Lagenina, Spirillinina in the Toarcian/Aalenian. Opportunistic small species bloom in the most anoxic levels of the black shales.

The sedimentological study reveals two peaks in the detrital sedimentation. The first – probably connected with local tectonics (without excluding sea-level changes) – is found in the interval from the Carixian to the lower part of the Lower Toarcian. Metre-scale cycles of fine-grained calcareous turbidites, due to low-density flows, evolve gradually into coarse-grained, metre-thick turbidites often amalgamated and containing reworked skeletal grains of a carbonate platform environment, and gravity flow deposits. The second peak occurs in the Middle-Upper Toarcian. Fine-grained turbidites are overlain by hummocky cross-stratified (HCS) deposits and winnowed beds (WB), with large and pervasive bioturbation. The vertical transition from turbidites to sharp-based HCS deposits and WB is probably indicative of a general regressive trend and of a depositional environment above major storm wave base. This trend has also been indicated from the microfossil study.

Geochemical analysis of the Lower Toarcian (Tenuicostatum Zone) has revealed strong positive anomalies in Ba, V, Cr, Ni, Co, Cu, Zn, As, Sb and Pb, elements which are characteristic of black shale episodes. Weaker positive anomalies occur in similar sediments of the lower part of MS Formation, while such positive anomalies are absent in the largely bioturbated sediments deposited below (COR) and above (RAUM) the MS.

Depositional trends related to tectonic-eustatic variations in the depositional environment are suggested on the basis of information provided by the study of the Valdorbia Section and of other Umbria-Marche sections.

RIASSUNTO

Sedimenti pelagici del Giurassico sono ben esposti lungo la sezione della Valdorbia (ENE di Gubbio, Appennino Centrale). Tale sezione è ben nota in quanto è indicativa della sedimentazione giurassica di mare aperto che ha sostituito, nel Lias inferiore dell'area Umbro-Marchigiana, la sedimentazione tipica di una piattaforma