(Fig. 14, 20 and 21). The sharp-based HCS calcarenites were probably formed under very rare, unusually stormy conditions that caused a strong oscillatory flow regime near the bottom during the Middle and Upper Toarcian. Characteristic abrasion surfaces on some benthic foraminiferal tests seem to be due to oscillatory conditions at the sediment/water interface during the deposition of the winnowed beds (Fig. 13). The minimum depth and sedimentation rate of the depositional environment was reached in the upper part of the Toarcian and corresponds roughly to an outer/middle shelf environment, near the major storm wave base (Fig. 21). Moreover in the Erbaense-Meneghinii Zones the succession is strongly condensed – testified by repeated hardgrounds – and represented by sediments only 7.5 m thick, in comparison with the Tenuicostatum-Bifrons Zones where deposits 60 m thick occur.

9.4 Tectonics and eustacy

The microforaminiferal assemblage BC present at the boundary between Corniola and Marne del M. Serrone is lacking in the Valdorbia area where Glomospirella disappears in the Upper Domerian, earlier than in the other areas. At the Domerian/Toarcian boundary slumps, mass-flow and calcareous turbidites occur. These sedimentary features can be interpreted as indicative of regional synsedimentary tectonics rather than a eustatic lowstand phase because this sedimentological character seems to be relatively local. Hence, the Domerian regressive stage expressed in the eustatic curve of Hallam (1988) is not evident in this area, probably because of local tectonic activity of M.Catria-Valdorbia area (Fig. 21).

The deepening found in the Tenuicostatum Zone can be connected to sea-level rise (Hallam 1967), according to the Jurassic eustatic curve of Hallam (1988), and/or to an increase in the rate of the subsidence (Fig. 21). In fact the degree of reworking reaches its maximum intensity in the Lower Toarcian.

The shallowing trend suggested for the Middle/Late Toarcian fits better into a geological context clearly affected by a regressive phase (Hallam 1988), than into one affected by tectonic activity (Fig. 21). In fact a regressive-shallowing can be considered to be widespread in the central Apennines, as in the Umbria-Marche basin and the Lazio-Abruzzi carbonate platform area (Giannini et al. 1970; Colacicchi & Bigozzi 1992). Mass-flow deposits which occurred in the Lower Aalenian are widely scattered in the Umbria-Marche area (M. Cucco, M. Serrone, Narni-Amelia ridge, M. Martani) and seem to reflect regional sea-floor instability. The cause of these features is still uncertain, although the Aalenian regression is probably the result of Western Tethys tectonics (Hallam 1988).

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