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Discussion

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Comment on "Palaeoenvironmental control on distribution of crinoids in the Bathonian (Middle Jurassic) of England and France" by Aaron W. Hunter and Charlie J. Underwood

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Aaron W. Hunter and Charlie J. Underwood in their article published in *Acta Palaeontologica Polonica* (Hunter and Underwood 2009) present some interesting results regarding facies control on the distribution of certain crinoids in the Bathonian of England and France. This is an important contribution, but we feel necessary to comment on some issues raised in their paper.

The first of these is the generality of the patterns described by the authors. While the authors state that: "the results were compared to crinoid assemblages from other Mesozoic localities, and it is evident that the same morphological adaptations are present within crinoids from similar lithofacies throughout the Jurassic and Early Cretaceous", it is rather unlikely that they examined available data from eastern Europe and the Crimea. The conclusion emerging from those data (papers by Klikushin, Hess, Głuchowski and Salamon; see references below) is that the distribution of crinoid species does not correspond well to particular facies. If such a pattern exists it does so only at much higher taxonomic levels (e.g., deep-water cyrtocrinids vs. shallow-water comatulids). To illustrate this apparent discordance we turn to several specific examples.

Hunter and Underwood found that "*Chariocrinus* and *Balanocrinus* dominate in deeper-water and lower-energy facies, with the former extending further into shallower-water facies than the latter" and that "both *Balanocrinus* and *Chariocrinus* were only abundant in shelly sediments; samples poor in shell debris lacked crinoids". Published work on Middle–Late Jurassic and Early Cretaceous crinoids from Eastern Europe, where numerous well-preserved pluricolumnals of both genera occur, reports them in deep or shallow-water clays, carbonates, and sandy facies (details in Klikushin 1992 and a few dozen references cited therein; Salamon et al. 2006, 2008; Salamon and Zatoń 2006, 2007; Salamon 2008a, b, 2009; Zatoń et al. 2008). The genus *Balanocrinu*s, one of the best-known and cosmopolitan genera, has been described repeatedly from shallow and deep-water facies of Europe and the Crimea (e.g., Hess 1975; Pisera and Dzik 1979; Głuchowski 1987; Klikushin 1982). With regards to the Hunter and Underwood's observation that "*Isocrinus* dominates in shallower water carbonate facies, accompanied by rarer comatulids, and was also present in the more marine parts of lagoons", we point out that *Isocrinus* (including *I. nicoleti*, mentioned by the authors as the indicator of shallow-water environment) is also abundant in deep-water (outer shelf) clay facies (Salamon and Zatoń 2007). In addition, data on crinoids from the Early Jurassic (Sinemurian–Toarcian) of Central Europe (Salamon et al. 2008) indicate that *Isocrinus* is abundant in deep-water carbonate facies (see also Głuchowski 1987); these data do not support Hunter and Underwood's statement that "*Isocrinus* was mainly restricted to silty and sandy sediments representing shallower-water and higher-energy palaeoenvironments in the Lower Jurassic". These authors also claim that "*Pentacrinites* remains are abundant in very high-energy oolite shoal lithofacies", but it should be pointed out that well preserved stalks of this genus are also known from deep-water clay (outer shelf) facies of central Poland (Salamon and Zatoń 2007).

In regard to millericrinids, Hunter and Underwood (2009: 77) state that "the presence of millericrinids within one, partly allochthonous lithofacies suggests the presence of an otherwise unknown hard substrate from which they have been transported". While we generally share this opinion, millericrinids could also have lived on soft bottom, where they could attach to hard objects (such as bio/lithoclasts).

We also found the analytical methods somewhat lacking in detail, in particular the description of the taphonomic features of crinoid ossicles (e.g., frequency of abrasion, bioerosion, dissolution, level of disarticulation gradient in each facies). This is especially relevant to Hunter and Underwood's (2009: 89) claim that "the lower energy lithofacies in the present study could represent largely in situ preservation of columnals". Given that crinoid pluricolumnals in the studied area were rare and sometimes abraded and no complete crinoids were recorded, this observation suggests transportation of crinoid material, making the reconstruction of the true population of the crinoids in each lithofacies from this disarticulated material equivocal. Furthermore, as pointed out by the authors, observations of modern crinoids indicate that isocrinid species disarticulate differently, making it difficult to reconstruct the true population of the crinoids in any of the lithofacies (Messing and Llewellyn 1992). Finally, we would like to add that isocrinids are not truly sessile benthic animals, but can actively migrate from one place to another, although the speed of locomotion is relatively low (Baumiller and Messing 2007).

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