Determinants of Mollusk Abundance in Quaternary cores of Po Basin, Italy

Michał Kowalewski[1], Rafał Nawrot[2], Daniele Scarponi[3], and Michele Azzarone[4]

[1]Florida Museum of Natural History, University of Florida, 1659 Museum Road, Gainesville, FL 32611, USA; mkowalewski@flmnh.ufl.edu

[2]Department of Palaeontology, University of Vienna, Althanstrasse 14, Vienna 1090, Austria; rafal.nawrot@univie.ac.at

[3]Dipartimento di Scienze Biologiche, Geologiche e Ambientali, University of Bologna, Via Zamboni 67, 40126 Bologna, Italy; daniele.scarponi@unibo.it

[4]Dipartimento di Scienze Biologiche, Geologiche e Ambientali, University of Bologna, Via Zamboni 67, 40126 Bologna, Italy; michele.azzarone2@unibo.it

Absolute abundance of fossils observed in cores and outcrops can be governed by extrinsic processes (e.g., net accumulation rates, intensity of taphonomic processes, post-mortem transport), intrinsic determinants of shell production rates (e.g., fecundity, spawning frequency, growth patterns), or some combination of those interdependent factors. Understanding the role of drivers of fossil abundance can enhance stratigraphic and biological interpretations of the fossil record. To assess the importance of extrinsic and intrinsic processes for fossil mollusks, we used a total of over 400 samples (each representing a 10-cm core interval and □0.375 dm^3 of sediment) derived from 12 cores from the late Quaternary sedimentary succession of the Po basin (Italy). The results indicate that although extrinsic factors such as compaction, net accumulation rates, and sequence stratigraphic context are to some degree controlling mollusk abundance in the cores, they cannot account for extremely shell-rich deposits. The results suggest instead that shell-rich core intervals record, primarily, episodes of high shell production rates. First, samples with very high shell density (> 4000 specimens per dm3) were characterized by extremely low evenness reflecting dominance by one super-abundant species, typically a small r-selective species capable of an explosive population growth (*Lentidium mediterraneum* and *Ecrobia ventrosa*). Second, a taphonomic test supported further the biological (R-hardparts model) rather than sedimentological (R-sediment model) origin of very dense shell concentrations: the quality of shell preservation correlates positively with shell density as predicted by R-hardparts model. The results suggest that intervals of high abundance of mollusk shells in cores record intervals of high biological productivity driven by opportunistic shelly species from lower trophic levels. Integrative studies of facies architecture, sequence stratigraphy, and paleontological data can help to differentiate biologically and physically produced fossil concentrations thus allowing for more informed ecological interpretations of the fossil record.