Improved methodology for measuring pore patterns in the benthic foraminiferal genus Ammonia

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Résumé en anglais	Benthic foraminiferal pores are considered to play an important role in facilitating the gas exchange between the organism and the environment, with pore size and density supposed to be related to gas exchange intensity. Recent studies have therefore attempted to establish relationships between pore patterns and redox conditions, such as bottom water oxygen and nitrate concentrations. However, a prerequisite for such an attempt is the development of a practical and reliable methodology for measuring pore patterns. The aim of this study is to present a semi-automated pore measurement method for Ammonia, a dominant taxon of temperate coastal environments that are increasingly affected by seasonal hypoxia (bottom water oxygen concentration < 63 μM). The approach is based on image analyses of a measurement frame positioned on SEM images with 1000 × magnification. Statistical analyses show that the surface area of the pores in the frame has a normal distribution. Therefore, a mean pore surface area can be used to describe the pores in the measurement frame. We observed small but significant ontogenetic changes in pore density (number of pores per frame) and pore surface area. Accordingly, it seems preferable to limit pore measurements to size windows on chambers representing the same ontogenetic stage. In order to demonstrate the efficiency of the method, we applied it in two case studies. Firstly, a study of living Ammonia in Lake Grevelingen (Netherlands) revealed a clear difference in pore patterns between three studied stations characterised by different seasonal bottom water oxygenation patterns. Secondly, a sediment core from the same site clearly showed the presence of two morphotypes of Ammonia; one with numerous, small pores and the other with fewer but much larger pores, resulting in a higher porosity (larger part of the test covered by pores). Since the man-made closure of Lake Grevelingen in 1971, the latter morphotype has progressively replaced the former one. Finally, a summary of the measurements on 870 specimens with both pore patterns shows a strong relationship between pore density and pore surface area, suggesting a physical control of the interaction between these two parameters.
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Liens

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