

Establishing baseline assessment levels for monitoring coastal heavy metals using foraminiferal shells: A case study from the Southeastern Mediterranean

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One of the challenges in monitoring the marine coastal environments is quantifying the magnitude and duration of pollution events. This study introduces a new concept of defining heavy metal (HM) baseline assessment levels (BAL) in coastal environments using foraminiferal shells. We demonstrated the potential of this approach by examining a nature reserve along the Mediterranean coast of Israel. Our previous investigation of this site in 2013-2014 using foraminiferal single chamber LA-ICPMS created a large dataset consisting of HM measurements of two species, *Lachlanella* and *P. calcariformata*. This database was used to establish the BAL of Zn, Cu and Pb, associated with anthropogenic sources. In February 2021, a significant oil spill event affected the entire Mediterranean coast of Israel, and included a considerable out wash of tar onto the shore. The event provided a unique opportunity to test the applicability of foraminiferal BAL by revisiting the previously studied site. Our strategy was to compare whole shell ICP-MS measurements of the two species collected shortly after the event and six months later, and compare them with the established BAL values. Our results revealed a significant increase (2-27 folds) in Zn/Ca, Cu/Ca, Pb/Ca ratios between 2013-14 and 2021. Among these, the increase in Pb/Ca is the most substantial and observed in both species. This implies a possible linkage between the oil spill event and the substantially elevated metals/Ca ratios measured by the foraminifera in 2021. Our study also demonstrates that bulk ICP-MS analyses will most likely yield similar ratios as those of average values of single chamber LA analyses of shells from the same location and period. This observation confirms that once BAL values are established, the analysis of bulk shell ICP-MS is effective for monitoring HM contamination of coastal environments.