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Revealing rangeomorph species characters using spatial analyses

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Rangeomorphs dominate the Ediacaran Avalonian macrofossil assemblages of Charnwood Forest, UK (∼565Ma). However, their unfamiliar fractal architecture makes distinguishing phylogenetically reliable characters from intraspecific features difficult. Fortunately, spatial analysis of large in-situ populations of such forms offers an independent means of assessing their taxonomy. Populations of a single biological species are likely to exhibit similar spatial distributions due to their shared responses to the biological and ecological processes acting upon them. As such, spatial analyses can be used to interrogate which are the most taxonomically deductive characters between similar species. We used Random Labelling Analyses to permutate the presence/absence of characters of Primocandelabrum boyntoni, P. aethelfalaedia and P. aelfwynnia from North Quarry 'B' surface. The resultant spatial distributions were compared using goodness-of- fit tests to determine which characters were associated with unique populations and which were found across multiple populations. We found that P. aethelfalaedia exhibited significantly different distributions to P. boyntoni and aelfwynnia suggesting that there are two rather than three Primocandelabrum species on the B surface. Furthermore, we found that Concealed versus Unconcealed 1st order branches
exhibited significantly different density dependant behaviour with Unconcealed branching occurring in the higher density areas, and Concealed branching in the lower density areas. This spatial heterogeneity may be caused by chemical gradients in the substrate, leading to higher densities of specimens in preferred habitat, with the unconcealment of these branches could either have been a behavioural or growth response due to competition within these preferred areas.