Supplemental File 5

SAMPLE IDENTIFICATION AND ANALYTICAL PROCEDURAL ADJUSTMENTS

Several of the analyses performed as described in Lehane and Ekdale (2014) have been adjusted based on repeated measurements to improve the quality of the data. These adjustments along with the procedure for naming the samples are described below.

Procedure for sample identifications

All samples were identified by the museum IDs where the samples are housed, if the samples were housed in a museum and the ID was known. Museum samples that did not have an identification number were just referred to their museum ID followed by "unk". For samples obtained from the literature, museum IDs were used if they were published; if not the samples were identified by the last names of the author(s), the year published, and the figure number of the specimen. If multiple specimens contained the same museum ID, then the samples were denoted with the museum ID, a dash (-), and a number starting with 1 and going up from there. Samples photographed in the field were identified with an abbreviation of the field locality (i.e., Z for Zumaia, VB for Vera Basin), a shortened species name, and a sequential numbering system.

Procedures for analyses

Generally, analyses were carried out as described in a previous publication (Lehane and Ekdale 2014). However, there were some modifications to those procedures as described below. For a review of the consistency of the analytical results, please refer to Supplemental File 7.

Meandering forms

For the meandering forms analyses it was determined that the burrow spacing for meandering forms should be equal to the average wavelength. To calculate out the average wavelength, the average half-wavelength was calculated by measuring the distance between the amplitudes along the midline of the burrow. The half-wavelength was then doubled to determine the full wavelength. If there is not enough information to calculate the amplitude, the half-wavelength was calculated by measuring the average distance between known adjacent burrows, and then doubled.

The method for calculating out the tortuosity produces segments of lines that are not exactly the length being measure (i.e., 5 cm, 10 cm, etc.). Therefore, each value in the spreadsheet (Supplemental File 4) takes into effect a range of values. The smallest value being measured, the 5.0 cm range, includes line segments from 2.5 cm to 5.0 cm in length. The segment values continue as such: 5.1 to 10.0 cm (10 cm), 10.1 to 15.0 cm (15 cm), 15.1 to 20.0 cm (20 cm), 20.1 to 25.0 cm (25 cm), and 25.1 to 32.5 cm (30 cm) in length.

Spiraling forms

Calculations of tortuosity were adjusted according to the method in the meandering forms in the same manner.

Branching forms

For the branching forms, the motility index (MI) was calculated much the same as it was for the meandering forms. However, only the main trunk of the trace was used for

the calculations. The main trunk was determined to be the series of branches that produced the longest continuous trace. As for the meandering forms, the burrow spacing also was calculated using the average wavelength. To create a more reliable measurement of the branching angle, the results of the branching angles were only reported if there were at least three clearly measurable branches available. For samples with less than three branches, the analyses were denoted as indeterminate. Calculations of tortuosity were adjusted according to the method in the meandering forms in the same manner.

Network forms

For the network forms, the weighted average of cell sides ($S_{Average}$), the variance in cell sides ($S_{Variance}$), and the mode in cell sides (S_{Mode}) were only calculated for samples were three clearly defined cells could be measured. For samples with less than three, the analyses were denoted as indeterminate. Network tortuosity was calculated by using progressively smaller boxes, each of which was reduced in size by 150 pixels on each edge. If the network tortuosity values did not level out, then they were either thrown out or the image was cropped to ensure that the center of the image was where the main portion of the trace fossil was located. As mentioned for the branching forms, the branching angles were only calculated for samples where at least three clearly measurable branches were available. For samples with less than three branches, the analyses were denoted as indeterminate. During measuring of the branching angles it was noticed that reproducibility of an individual measurement was within ± 2.5° (a range of 5°).

Literature Cited

Lehane, J. R., and A. A. Ekdale. 2014. Analytical tools for quantifying the morphology of invertebrate trace fossils. Journal of Paleontology 88:747–759.