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USING FRACTALS TO CHARACTERIZE THE INTERSPECIFIC VARIABILITY OF CORALS

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Introducing the notion of „fractals" by Mandelbrot (1967) was a major revolution in several branches of science such as physics (see Kaye 1989; Gouyet 1992), medicine (see Nonnenmacher 1994), microbiology (see Smith et al. 1989) and botany (to characterize leaf shape, see Vlcek and Cheung 1986). Fractal growth phenomena enable one to simulate and to explain a complex behavior such as biological growth in corals, sponges, seaweeds (e.g., Kaandorp and Sloot 2001), stromatolites (Verrecchia 1996) and plants (see Prusinkiewicz et al. 1996).

This study proposes a new method for the morphometrics, which describes and characterizes the calicular and septal morphologies of five Recent scleractinian species (*Eusmilia fastigiata, Dichocoenia stokesi, Montastraea annularis, Montastraea faveolata* and *Montastraea franksi*) and one Jurassic species (*Aplosmilia spinosa*) using only the two parameters introduced by Kaye (1989): (1) the structural fractal dimension (δs) characterizing the overall structure of the corallite and (2) the textural fractal dimension (δt) describing the texture or fine details at the septal level. In this study, the Counting-Box Method was used. It works by laying a net of various mesh (box) sizes r over the image object, then evaluating the number of boxes N, which are needed to cover completely the fractal (the image object). Repeating the measurement with different sizes of boxes, forming the net will result in a logarithmical function of the box size (log r on the x-axis) against the number of black and white boxes needed to cover the object (log N_{BW} on the y-axis). The plotting of the data on log-log scales known as a Richardson Plot yields two fractal slopes, that may be identified by an equation ($\log N(r) = \delta(\log(1/r)) + \log k$) and by a maximal coefficient of determination r-squared. Both slope coefficients correspond to the fractal dimensions δs and δt.

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