3D tomography on an Early Jurassic coral: solving a paleontological question by non-destructive investigations

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“Mesophyllum” pseudocolumellatum, a Pliensbachian/Sinemurian coral is of scientific interest as it is a fossil that went extinct during the Pliensbachian/Toarcian transition. In addition, this cnidarian is important because of a distinctive skeletal organization; the axial structure of the corallite, with no equivalent in Mesozoic taxa, is reminiscent of the skeletal organization of some Palaeozoic rugose corals based on the occurrence of a calicular boss. Thus, two questions arise: is the apparent similarity between these two structures due to an evolutionary convergence or is this organization inherited by “M”. pseudocolumellatum from a Palaeozoic ancestor? As two distinct pseudocolumella shapes can be distinguished in “M”. pseudocolumellatum populations, are the two pseudocolumella shapes a result of two distinct species within the genus? The morphological aspects of the skeleton have been assessed in order to understand the function and growth of this axial “calicular boss” as well as to describe more precisely the genus and species characters. To answer these questions, we analyzed samples with Computed Tomography X-ray scans (CT scans). The X-ray tomograph is a Nanotom Phoenix (GE) of GeoRessources laboratory in Nancy. CT scanning is a non-destructive technique used to inspect the internal structure of solid specimens based on recording attenuation levels of X-rays after passing them through a specimen. After acquisition the digital sample can be analysed (e.g., digital cross sections can be made, phases can be separated and surfaces, volumes, and orientations measured). Two samples (A57331-1 and AM16161) have been chosen for their sufficient density contrasts between skeleton and matrix. These analyses revealed the coexistence of the two distinct pseudocolumella morphologies in one sample, corresponding to two distinct stages in the life of the animal. This observation excludes the distinction of two distinct species under the genus on the basis of the different apparent pseudocolumella shapes. Moreover, the question of the link between “M”. pseudocolumellatum and Palaeozoic corals is answered by the organization of the septal apparatus observed in tomography and thin sections, which points to a Scleractinian Bauplan. This is also supported by the aragonitic nature of the initial skeleton. Together, these data suggest a convergence phenomenon, leaving open the question of the functional significance of such a calicular organization.

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