Microfossil Taxonomy in the 21st Century

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As research of the fossil groups utilized in biostratigraphy matured through the 20th century and into the 21st, studies evolved from taxonomy to distribution (spatially and chronologically) to application (e.g. paleoenvironment, paleoceanography, evolution, sequence stratigraphy, age modeling, and pollution). With the advent of computer modeling and statistics, researchers are now distanced from the actual fossils, which have become a series of data points. This, coupled with the decline of the number of professors overseeing basic microfossil research, suggests that in the near future there may be a shortage of micropaleontologists able to generate quality data, that fossil datasets may contain numerous misidentifications or may lack adequate subdivision, and local markers and zonation schemes could be lost. This last item is further exacerbated by the globalization of the biostratigraphic workforce, decreasing the number of experts in local benthic faunas, and leaving little time or inclination for most workers to become adequately familiar with them.

To address this situation it is recommended that the new methods of digitally capturing images be applied to key species, especially poorly imaged type specimens and local benthic markers. New methodologies have been formulated to enable photographs to be taken with a light microscope that place the entire specimen in focus, yielding an image that looks very close to what the paleontologists sees under the microscope. Typically these methods composite multiple images, with each individual image focused on a different portion of the fossil. A new method introduced here utilizes a Zeiss Universal microscope, enabling the camera to be positioned much further from the specimen and thus placing most, if not all, of the specimen in focus. This method also enables photographs to be taken at much higher magnifications than the typical stereo-microscope. With these digital images, it is possible to construct three-dimensional images that can be manipulated much like one manipulates a loose foraminiferal specimen. Movies can also be made of calcareous nannofossils, either focusing vertically through the specimen or rotating the stage with cross-polarized light. Further emphasis also needs to be placed on biometric analyses, which can yield additional understanding of how species can best be differentiated, as well as applications in evolutionary studies and detailed stratigraphic correlations.