Micropaleontological Dead Ends

Interest in microfossils seemed to fade

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- Author: Filippo Bertoni
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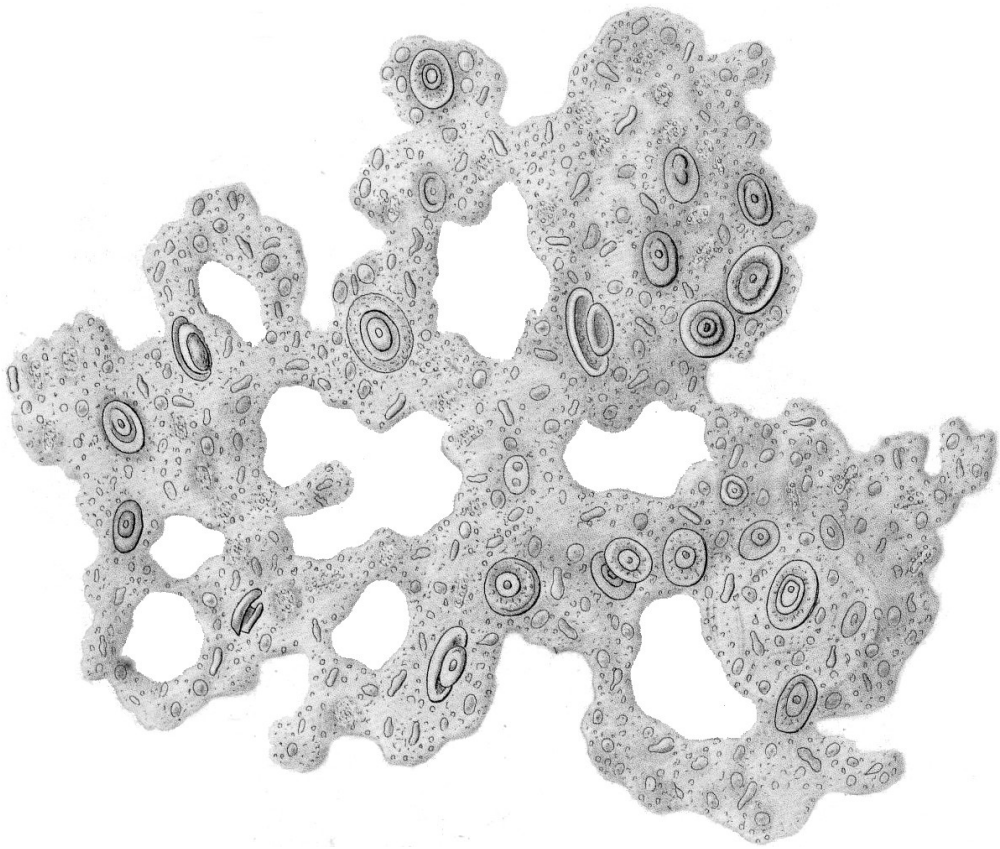

A lithographic illustration of Bathybius haeckelii, *which was believed to be a primordial protoplasm from the ocean floor and to offer evidence of the connection between inorganic matter and organic life. When the gelatinous substance was proven to be an inorganic artifact caused by the alcohol used to preserve the samples, the controversy surrounding it contributed to slowing down early advances in micropaleontology.*[1]

By the second half of the 19th century, naturalists' observations revolutionised the scientific understanding of nature and brought more order to the chaotic origins of micropaleontology. Significant improvements in microscopy after the 1830s[2] (which allowed the formulation of modern cell theory[3]) and the mounting evidence for the transmutation of organisms, which culminated in the 1850s with Charles Darwin's and Alfred Russel Wallace's evolutionary theories,[4] aided these observations. However, despite these innovations, the characterisation of microbial life and its role in the functioning of the planet and its history was still only beginning to take shape. Many naturalists continued the efforts of Alcide d'Orbigny and Christian Gottfried Ehrenberg to describe and classify microbial diversity.[5] They were also driven by the intent to overcome the creationist positions of these 'founding fathers', who still considered evolution to be

unfounded. Nevertheless, these early attempts to connect microorganisms and the evolution of life on the planet soon met with what seemed to be a dead end.

In the case of Foraminifera, this is evident in the work of William Benjamin Carpenter,[6] who in the 1860s rejected Alcide d'Orbigny's systematisation. Proposing a different interpretation of foraminiferans, he questioned the value of the notion of species for these organisms. Carpenter also authoritatively concluded that the great range of variation in this group was not representative of evolution into more complex forms, but instead indicated that they changed little over geological time. While dismissing the creationism of d'Orbigny, this view legitimised the misconception that foraminifera were not interesting to paleontology. According to Carpenter, they had remained essentially the same throughout the planet's history. During the same time, Radiolaria also underwent a reclassification that was more attuned to the rise of evolutionism – but the evolutionary depths of these microorganisms was not recognised either. Ernst Haeckel, a young German naturalist, chose to focus on these organisms in his doctoral work, which, until then, had almost exclusively been studied by Ehrenberg. Haeckel's goal was to organise them in a better 'natural system'.[7] As he encountered the work of Charles Darwin, Haeckel immediately became an ardent supporter and introduced an evolutionary perspective in his successful radiolarian work. Even an enthusiast like Haeckel, however, eventually supported the view that these microorganisms changed little and slowly over geological time. This view was consolidated with the HMS Challenger expedition in the 1870s: the first comprehensive oceanographic survey of the world's oceans.[8] As the scientists and crew of the expedition collected thousands of specimens and data, and recorded observations, the foremost experts of the time were mobilised to analyse and report on the expedition's findings.

Haeckel was charged with reporting on the radiolarians and Henry Bowman Brady[9] with reporting on the foraminiferans. Detailed, rigorous, and artfully illustrated, both reports enjoyed much success and came to represent the crowning achievements of 19th century natural sciences. Their encyclopedic work – together with that of the other scientists studying the HMS Challenger materials – still serves as foundation for many aspects of today's oceanography, and profoundly shaped our understanding of nature. But while their descriptive value is still appreciated, both reports eventually reconfirmed the mistaken idea that microorganisms evolved only slowly and over long geological ranges. Even before being truly born, micropaleontology faced a premature death, as microfossils became disconnected from geological time in these early studies. This understanding prevailed until an unexpected discovery was made in 1921 by a group of young geologists, which successfully launched what came to be known as industrial micropaleontology.

Footnotes

1. Ernst Haeckel. "Beiträge zur Plastidentheorie". *Jenaische Zeitschrift für Medizin und Naturwissenschaft* 5 (1870), Plate 17, Fig. 1. To learn more about *Bathybius*, see John R. Dolan. "The Famous and Lesser-Known Illustrations of Thomas Huxley's Bathybius". *History of Oceanography*, 13.07.2020, https://oceansciencehistory.com/2020/07/13/the-famous-and-lesser-known-illustrations-of-thomas-huxleys-bathybius/ (03.01.2022); Philip F. Rehbock. "Huxley, Haeckel, and the Oceanographers: The Case of Bathybius Haeckelii". *Isis* 66, no. 4 (1975): 504-533. http://www.jstor.org/stable/228925.↩
2. On the history of microscopy, see "History of Microscopy: Timeline". *Science Learning Hub – Pokapū Akoranga Pūtaiao*, 30.09.2016. https://www.sciencelearn.org.nz/resources/1692-history-of-microscopy-timeline (03.01.2022); Robert R. Shannon and Brian J. Ford. "Microscope". *Encyclopedia Britannica*, no date. https://www.britannica.com/technology/microscope/History-of-optical-microscopes (03.01.2022); "Microscopes". *National Museums Scotland*, no date. https://www.nms.ac.uk/explore-our-collections/stories/science-and-technology/microscopes/ (03.01.2022); Rudi Rottenfusser, Erin E. Wilson, and Michael W. Davidson. "Microscopy: Historical Perspective". *Zeiss*, no date. https://www.zeiss.com/microscopy/int/solutions/reference/basic-microscopy/microscopy-historical-perspective.html (03.01.2022). For a more in-depth history, see A.J. Wollman, R. Nudd , E.G. Hedlund, and M.C. Leake. "From Animaculum to Single MOlecules: 300 Years of the Light Microscope". *Open Biology* 5 (01.04.2015): 1-10. https://doi.org/10.1098/rsob.150019.↩

3. To read more about the development of cell theory, see Ohad Parnes. “The Envisioning of Cells”. *Science in Context* 13, no. 1 (2000): 71-92. https://doi.org/10.1017/S0269889700003720; M.L. Richmond. “Protozoa as Precursors of Metazoa: German Cell Theory and its Critics at the Turn of the Century”. *Journal of the History of Biology* 22 (1989): 243-276. https://doi.org/10.1007/BF00139514; Natasha X. Jacobs. “From Unit to Unity: Protozoology, Cell Theory, and the New Concept of Life”. *Journal of the History of Biology* 22, no. 2 (1989): 215-242. http://www.jstor.org/stable/4331093↩
4. There are many resources to learn more on Darwin, Wallace, and evolutionary thought: “Natural Selection: Charles Darwin & Alfred Russel Wallace”. *University of California Museum of Paleontology*, 22.08.2008, https://evolution.berkeley.edu/evolibrary/article/0_0_0/history_14 (03.01.2022); J. Norman. “Darwin & Wallace Issue the First Printed Exposition of the Theory of Evolution by Natural Selection”. *History of Information*, 25.11.2014, https://www.historyofinformation.com/detail.php?id=1655 (03.01.2022); *Darwin Correspondence Project* , 2020. https://www.darwinproject.ac.uk (03.01.2022); Alexandra Stober. “Evolutionsforschung: Charles Darwin, Revolutionär und Gentleman”. *Planet Wissen*, 02.06.2020. https://www.planet-wissen.de/natur/forschung/evolutionsforschung/pwiecharlesdarwinrevolutionaerundgentleman100.html (03.01.2022). For a more in-depth history, see James T. Costa. *Wallace, Darwin, and the Origin of Species*. Cambridge: Harvard University Press, 2014. http://www.jstor.org/stable/j.ctt6wprf8↩
5. See Early Micropaleontology for more on these early works.↩
6. For a short biography of Carpenter and his relevance to micropaleontology, see “William Benjamin Carpenter, 1813-1885”. *Cushman Foundation for Foraminiferal Research*, no date. https://cushmanfoundation.org/PersonifyEbusiness/Resources/Gallery-of-Foraminiferal-Researchers (23.01.2022).↩
7. On Haeckel’s career and life, see Robert J. Richards. *The Tragic Sense of Life: Ernst Haeckel and the Struggle over Evolutionary Thought*. Chicago and London: University of Chicago Press, 2009.↩
8. This was one of the most celebrated oceanographic scientific explorations of the 19th century. See Ben Lerwill. “HMS Challenger: The Voyage that Birthed Oceanography”. *BBC Online*, 21.07.2020. https://www.bbc.com/travel/article/20200719-hms-challenger-the-voyage-that-birthed-oceanography (03.01.2022); Kate Golembiewski. “H.M.S. Challenger: Humanity’s First Real Glimpse of the Deep Oceans”. *Discover Magazine*, 20.04.2019. https://www.discovermagazine.com/planet-earth/hms-challenger-humanitys-first-real-glimpse-of-the-deep-oceans (03.01.2022). For a more in-depth history, see Helen M. Rozwadowski. *Fathoming the Ocean: The Discovery and Exploration of the Deep Sea*. Cambridge: Harvard University Press, 2005.↩
9. For a biography of Brady, see C.G. Adams. “Henry Bowman Brady, 1835-1891”. *Cushman Foundation for Foraminiferal Research*, no date. https://cushmanfoundation.org/PersonifyEbusiness/Resources/Gallery-of-Foraminiferal-Researchers (23.01.2022).↩