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**Decimeter-scale multicellular eukaryotes from the 1.56-billion-year-old Gaoyuzhuang Formation, North China**

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Unambiguous fossils of macroscopic eukaryotes are widespread in Ediacaran (635 – 541 Myr) sedimentary rocks. With this in mind, the late Neoproterozoic Era has commonly been viewed as a time of transition from an earlier microbial biosphere to the world of conspicuous macroscopic organisms we know today<sup>1</sup>. Statistically, this view is correct, but reports of older macroscopic fossils have been published for years, including the Mesoproterozoic helicoid *Grypania*, string-of-beads impressions named *Horodyskia*, and scattered carbonaceous compressions of irregular or indeterminate shape. Both the cellular structure and phylogenetic affinities of these fossils remain uncertain<sup>2,3</sup>. In particular, carbonaceous microfossils up to 2 cm long, previously reported from the upper Paleoproterozoic (>1625 Myr) shales in North China, have irregular shapes and lack cellular structure, making it impossible to differentiate them from ripped-up and redeposited fragments of microbial mats<sup>2,4</sup>.

Here we report the discovery of macroscopic fossils from the 1560-Myr-old Gaoyuzhuang Formation, eastern Yanshan area, North China, that exhibit both large size and regular morphology. Preserved as carbonaceous compressions within calcareous marine shales, the Gaoyuzhuang fossils have statistically regular linear to lanceolate shapes up to 30 cm long and nearly 8 cm wide. Such features suggest that the Gaoyuzhuang fossils record benthic multicellular eukaryotes of unprecedentedly large size. Syngenetic fragments freed by maceration showing closely packed ca. ~10 µm cells arranged in a thick sheet further reinforce the interpretation. Comparisons with living thalloid organisms suggest that these organisms were photosynthetic, although their phylogenetic placement within the Eukarya remains uncertain. The new fossils provide the strongest evidence yet that multicellular eukaryotes with decimetric dimensions and a regular developmental program populated the marine biosphere at least a billion years before the Cambrian diversification of animals.

*References:*

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