

PARMALES: AN INSIGHT INTO THE ORIGIN AND EVOLUTIONARY SUCCESS OF DIATOMS

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The order Parmales (Heterokonta) is a small marine phytoplankton group, 2 to 5 μm in diameter, with a silicified cell wall composed of several plates. Parmales is widely distributed in the world's oceans, from polar to subtropical regions, and is often abundant in polar and subpolar waters. Based on similarities in cell wall structure, Parmales has been proposed as a close relative of diatoms and may play a key role in answering questions on the origin of their silica cell wall and early evolution, which have not yet been clearly established. However, we still have very little biological information on Parmales, due to the lack of laboratory investigations. Recently, with the aid of a fluorescent silicon tracer PDMPO, we isolated the first ever culture of Parmales from the coastal Oyashio region of Japan in the Western Subarctic Pacific. SEM, TEM, molecular phylogenetics and photosynthetic pigments analyses of this culture indicated that Parmales was within the bolidophycean clade of autotrophic naked flagellates and a sister group of diatoms. It can be hypothesized that parmalean and bolidophycean algae (or their common ancestor) have a life cycle that switches between silicified non-flagellated and naked flagellate stages. This hypothetical life cycle would be similar to centric diatoms, which have a vegetative stage that switches to production of naked flagellated male gametes (sperms) for sexual reproduction. Understanding how the life cycle of such a hypothetical ancestor of Parmales and Bolidophyceae relates to that of diatoms is a key question to understand the early evolution of diatoms. We present our ongoing study of the evolutionary close relationship between Parmales, Bolidophyceae and diatoms using ecological, physiological, genomic and biogeochemical approaches.