Phytoliths in grass and non-grass species: Pattern, function and evolution

Ofir Katz*[1]

[1]Ben-Gurion University of the Negev and Dead-Sea and Arava Science Center – Israël

Résumé

A large portion of what we know about phytolith formation and function is derived from studies on grasses, which are one of the most phytolith-rich plant families. Non-grass species are seldom studied because of their low phytolith contents, and it is uncertain to what extent phytolith formation patterns and functions in grasses also apply for non-grass species.
Studying phytolith contents in Asteraceae species along a large rainfall gradient in Israel, in both grazed and ungrazed plots, has revealed that phytolith formation patterns in grass and non-grass species differ in several aspects. While grass phytolith contents along rainfall gradients tend to be higher in rainier sites (due to greater water availability) and extremely arid sites (due to small body size and the protective roles of phytoliths against aridity and herbivory), Asteraceae species did not show any single clear pattern. Moreover, while grass species tend to form more phytoliths when exposed to herbivory, and have higher phytolith contents in inflorescences compared to vegetative shoot parts, the opposite is often observed in Asteraceae species. These results suggest differences in phytolith functions between grass and non-grass species, especially in relation to aridity and herbivory.
Nonetheless, further analysis of phytolith abundance in angiosperms reveals that orders in which phytolith-rich taxa occur have emerged mostly during the Early/Late Cretaceous boundary and have diversified mostly during the Late Cretaceous. This suggests that phytolith-rich angiosperms share an early evolutionary history. The Late Cretaceous is also characterized by the evolution of more derived dentition among certain herbivorous dinosaur groups such as the hadrosaurs and ceratopsians, which are thought to be better adapted to abrasive (potentially phytolith-rich) food. Thus, it is possible that the emergence of multiple phytolith-rich angiosperm clades during this time is connected to changes in dinosaur diets. Such a connection can be through a direct plant-herbivore escalation, but also because dinosaurs with silicon-rich diets excreted more readily-available silicon that could be exploited by phytolith-rich plant clades. Hence, the functional history of this unique plant trait is starting to be revealed, and may provide new insights as to the role silicon plays and has played in plant and global ecology.

Mots-Clés: Ecology, water, herbivory, evolution, role

*Intervenant