

Depositional environment and pyritization of chrysophyte cyst fossils in shales during the Triassic Carnian Pluvial Episode, Ordos Basin, China

JINGJING CAO AND WENZHE GANG

China University of Petroleum Beijing
 Presenting Author: jingjingcao95@163.com

Chrysophytes are primarily freshwater algae that produce siliceous cysts (termed statospores, resting spores, or stomatocysts) during their resting stages. Chrysophyte cysts can be well-preserved in sediments as microfossils [1]. Chrysophyte cysts are generally indicators of environmental reconstruction in modern lake sediments. Widely pyritized and preserved chrysophyte cyst fossils were found in black shales from the seventh member of the Yanchang Formation (Ch7 Mbr), the most important rock source in the Ordos Basin (Figure 1). The age, depositional environment, and pyritization model of these fossils have not been studied previously. In this study, the astronomical orbital cycles of the Ch7 Mbr were determined based on gamma ray series of Yan56 and Zhen 421 wells. The $^{206}\text{Pb}/^{238}\text{U}$ isotopic age of zircons in the tuffs at the bottom of Ch7 Mbr was 234 Ma. Astronomical time scale (ATS) analysis revealed that the depositional duration of the Ch7 Mbr was approximately 5 Ma. The ages of three sub-Mbrs in the Ch7 Mbr were estimated at 234.0–232.4 Ma, 232.4–230.8 Ma, and 230.8–229.1 Ma. Six types of chrysophyte cyst fossils, well-preserved by pyritization, were discovered in the Ch7 Mbr black shales with different pores, collars, and surface ornamentation. The age of the chrysophyte cyst fossils was at least 233.6 Ma in the Triassic Carnian Pluvial Episode (CPE) based on the 405 kyr tuned ATS. Models of chrysophyte cyst preservation indicated that fossil pyritization was caused by bacterial sulfate reduction near the water-sediment interface under suboxic to anoxic environmental conditions. Pyritization was initiated on the walls of the chrysophyte cysts by the formation of microcrystalline pyrite. Because of the gradual pyritization of the chrysophyte cyst wall, the organic matter in the interior of the fossil was well preserved. The results of this study suggest that pyritization substantially contributed to the preservation of chrysophyte cyst fossils during CPE (Figure 2).

[1] Zhang, W. Z., Yang, H., Xia, X. Y., Xie, L. Q., Xie, G. W. (2016). Triassic chrysophyte cyst fossils discovered in the Ordos Basin, China. *Geology* 44, 1031–1034.

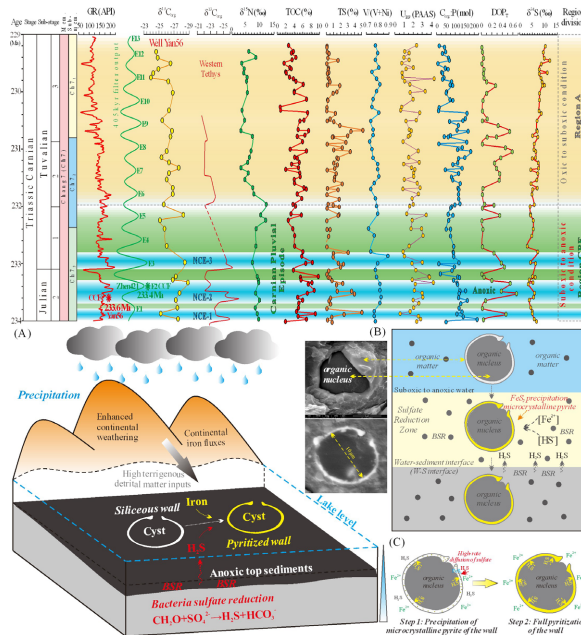
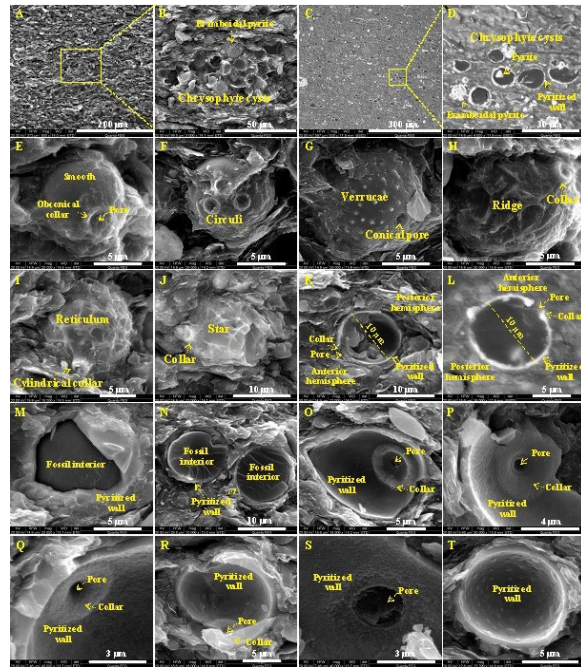


Figure 1. Scanning electron micrographs (SEM) of chrysophyte cyst fossils. Figure 2. Depositional environment and pyritization model.