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The record of caddisfly-dominated microbial-carbonated bioherms from the Early Cretaceous Yixian Formation in western Liaoning, China: occurrence and palaeoenvironmental implications

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Along with numbers of tube-shaped caddisfly larval cases, caddisfly-dominated microbial-carbonated bioherms have been recently discovered in the Early Cretaceous lacustrine deposits-Yixian Formation in western Liaoning, China. They are discovered just under abundant well-preserved Jehol biota fossils which Yixian Formation is famous for. Caddisfly-dominated microbial-carbonated bioherms are carbonated bioherms that caddisfly larva built by incorporation with cyanobacterial mat, which are seldom found in modern freshwater, fluvial environments.

Caddisfly larval cases discovered in Panjiagou section are encrusted by microbial layers and formed bioherms. These tube-shaped cases are similar in size (12-14mm in length and 3-4mm in diameter). Primordially they are vertical close packed, and they are subparallel to each other. In some cases, ostracod shells or rock debris and ooids dominate the particles, while the proportion of three kinds of particles is similar in other cases. All of the three kinds of particles are oriented sub-parallel along the cases walls, and all single shell of ostracod are closely arranged with their back to the long axis of the case. Some of the tubes are made up of microbial layers without particles.

Besides of the caddisfly larval cases formed bioherms, there are more single cases without bioherms structures, which are widely discovered in Yixian Basin. These single cases are more than 1cm in length and 2-3mm in diameter with no microbial carbonated layers. They are composed of various materials and are distributed in five sections in Yixian basin with high or low density. These single cases are fully described too.

Considering of the bioherms and widely distributed single cases, once a special biome mainly composed of caddisfly larvae and microbes flourished during Early Cretaceous in Yixian Basin. Together they built

special bioherms on which their flourish relayed. According to the size, particles and protogenic direction of the cases, the caddisfly larval cases are not built by only one species. And numbers of stationary cases that are very rare all over the world are discovered. Besides Yixian Basin in western Liaoning province, Caddisfly-dominated microbial-carbonated bioherms are discovered in other two Early Cretaceous basins in the Far East: Liupanshan Basin in Ningxia province and Gyeongsan Basin in Korea. The widely distributed may provide more information for the evolution of Trichoptera during the first flourish period of insects.

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