**Occurrence and significance of minute palynomorphs of marine and non-marine origin in the Middle Ordovician from Saudi Arabia**

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**ABSTRACT**

Abundant and well-preserved palynomorph assemblages occur in core samples across the transition between the Sajir Member of the Saq Formation and the Hanadir Member of the Qasim Formation in central Saudi Arabia. Organic-walled microfossil assemblages include cryptospores, acritarchs, chitinozoans, cuticle-like fragments and other problematic forms together with more or less abundant amorphous organic matter. The Hanadir Member of the Qasim Formation is biostratigraphically well-constrained by the presence of chitinozoans of the successive *formosa* and *pissotensis* zones of early to late Darriwilian age. The biostratigraphic age of the Sajir Member is considered to span through the Dapingian-Darriwilian boundary although definitive age evidence is lacking.

In this paper we describe previously unreported assemblages of small microfossils of the picoplanktonic and ultraplanktonic size classes, which are key components of the palynological assemblages. Among these small microfossils are unornamented sphaeromorphs, which occur in either isolated or irregular clusters. Others are small acritarchs or prasinophycean phycomata, of 5 to 15 µm in total diameter, which display complex morphologies especially when observed under SEM, and which represent a unique assemblage with no described counterparts in other Middle Ordovician successions. The smallest elements that we encountered in this study were stained nanospheres of 500 nm to 1µm in diameter, which occur embedded within organic-rich mats. These minute forms had not been detected before, because in standard palynological preparations, particles less than 10 to 15 m in diameter are usually discarded by sieving and/or are not generally reported in palynological publications.

We discuss the depositional distribution and paleobiological significance of these small palynomorphs in terms of marine eukaryotic and prokaryotic (e.g., cyanobacteria) ultraplankton, as well as the possible connection of their remains to those of terrestrial or freshwater biota.