

Cryptospore and miospore assemblages from Upper Ordovician (Katian-Hirnantian) strata of the Alborz Mountain Ranges, Northeastern Iran: Palaeophytogeographic and Palaeoclimatic implications

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In this paper, for the first time from Iran, well-preserved cryptospore and miospore assemblages are recorded from deposits of Late Ordovician (Katian-Hirnantian) age in the Alborz Mountain Ranges, Northeastern Iran. The cryptospore and miospore taxa are associated with diagnostic marine palynomorphs (acritarchs and chitinozoans), which suggest a well-dated age for the cryptospore-bearing samples. The encountered cryptospore and miospore taxa were produced by early primitive land plants which probably grew close to the shoreline and presumably washed in from the adjacent areas and constitute a high percent (58%) among other palynomorph groups. Cryptospore and miospore assemblages were obtained from the outcrop samples of Ghelli Formation which is located at Pelmis gorge, approximately 32 km southern Bojnour city. In this study, eighteen species (10 genera) of cryptospore and miospore were recognized. In composition, the Iranian cryptospore and miospore assemblages are similar to those described from coeval strata worldwide, suggesting that plant producers were cosmopolitan and tolerated a wide range of climatic conditions. The recovery of diverse and abundant cryptospore and miospore taxa in Katian-Hirnantian deposits of Iranian platform may be related to increased input of land-derived sediments during the global sea-level fall linked to the Late Ordovician glaciation, but it also demonstrates that the early land plants could have tolerated a wide range of climatic conditions. The associated marine organisms are

both acritarchs and chitinozoans. The chitinozoan species were assigned to *Armoricochitina nigrica*, *Ancyrochitina merga*, *Tanuchitina elongata* and *Spinachitina oulebsiri* biozones and suggest that the study area has been part of peri-Gondwanan paleoprovince during the Late Ordovician (Katian-Hirnantian). Likewise, the important acritarch taxa of this study are: *Orthosphaeridium rectangulare*, *Dactylofusa striata*, *Acanthodiacrodium crassus*, *Ordovicidium elegantulum*, *Dactylofusa ctenista*, *Dactylofusa cucurbita*, *Dactylofusa striatifera*, *Baltisphaeridium oligopsakium*, *Baltisphaeridium perclarum*, *Villosacapsula setosapellicula*, *Navifusa ancepsipuncta*, *Gorgonisphaeridium antiquum*, *Multiplicisphaeridium bifurcatum*, *Leiofusa fusiformis*, *Safirotheca* sp. cf. *S. safira*, *Dactylofusa platynetrella*, *Dactylofusa cabottii*, *Dorsennidium hamii*, *Multiplicisphaeridium irregulare*, *Veryhachium trispinosum*, *Veryhachium lairdii* and *Tytopalla* sp. Amongst the aforementioned acritarchs, the netromorph acritarchs comprises the 60% of recorded taxa. For the other taxonomic categories, relative abundances are as follows: *Veryhachium trispinosum* and *Veryhachium lairdii* groups, 20%; acanthomorph acritarchs, 15%; others, 5%. These recorded abundance distributions of the various taxa are consistent with a palaeobiogeographical attribution of the Iranian Upper Ordovician assemblages to the peri-Gondwanan domain.