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Plant microfossils from the early Silurian (Llandoverian) from western Libya

Mohamed Elkelani (1), Gert Jan Reichart (1), Wolfram Kurschner (2), Jaap S. Sinninghe Damsté (1,3), Klaas G.J. Nierop (1), Henk Brinkhuis (2,4), Zwier Smeenk (2), and Peter Nederlof (5)

(1) Utrecht University, Department of Earth Sciences - Geochemistry, Utrecht, Netherlands (m.elkelani@geo.uu.nl, +31-30-253.5302), (2) Utrecht University, Institute of Environmental Biology, Faculty of Science, Utrecht, Netherlands , (3) NIOZ Royal Netherlands institute for sea Research. Texel, Netherlands , (4) Utrecht University, Institute of Environmental Biology, Biomarine Sciences, Utrecht, Netherlands , (5) Shell Exploration & Production, Rijswijk

Organic microfossils (spores and phytodebris) provide earliest evidence for land plants during the early Silurian (late Llandoverian) in Northern Africa. Organic rich black and grey shale and siltstones drilled from the Libyan Tanezzuft Formation were investigated palynologically and organic geochemically. These sediments were deposited during a transgression, followed by a prograding delta. Hence the Tanezzuft Formation comprises sediments from relatively open marine to shallow, shoreface facies. The studied interval contains well-preserved and abundant palynomorph assemblages, comprising cryptospores, acritarchs, chitinozoans, scolecodonts, and prasinophytes. Together these fossils provide a solid age assessment. In the same interval fragmental remains of plants and marine animals were recorded. These plant remains are used as conclusive evidence for the occurrence of higher plants on the North African shore during the early Silurian.

The marine acritarch flora is accompanied by common non-marine miospores and cryptospores suggesting a proximal position and significant admixing of land-derived material into the marine setting. Overall, from the organic rich facies at the base of the Tanezzuft the non-marine palynomorphs increase, which is in line with the setting becoming more proximal. Organic geochemical analyses (GC-MS and pyrolysis GC-MS) of extracted biomarkers and isolated cuticles confirm the non-marine nature of the organic matter in the upper part of the Tanezzuft Formation.

Our investigations indicate that non-marine palynomorphs and land plant remains are abundant in the lower Silurian deposits in North Africa. Glacio-eustatic sea-level fluctuations during the late Ordovician may have been instrumental for the advent of land plants in the early Silurian. The finding of these land plants here suggests that plant evolution started 25 million years earlier than hereto assumed.