

Early Pliocene shifts in the Polar Front? Ecological signals of fossil marine palynomorphs from Northern Iceland

Verhoeven Koen and Stephen Louwye

Research Unit for Palaeontology, Department Geology and Soil Sciences, Ghent University, Krijgslaan 281, WE13, S8, 9000 Ghent, Belgium

E-mail: Koen.Verhoeven@UGent.be; Stephen.Louwye@UGent.be

Deposits from the Tjörnes Peninsula in northern Iceland permit to assess past ocean currents and the influence of the nearby island. Most palaeoecological studies with dinoflagellate cysts focus on deep marine or shelf settings and deal with outer neritic and oceanic species. Dinoflagellate cyst studies of marginal marine settings are scarce and represent only short time intervals. The Tjörnes section however accumulated 1200m sediments that are mainly shallow marine. It is the only place in Iceland with such a large marine record. As the island is formed by, still active, magmatic processes from its centrum, sedimentation of clastic rocks was only possible on its margins of which the sediments in Tjörnes were uplifted afterwards. The position of Iceland, central in the North Atlantic and just below the present-day Polar Front (PF), allowed registration of changes in the position of this PF and sea currents. The studied sediments are attributed to the Early Pliocene Tjörnes beds (68 samples) and signal the onset of the Quaternary cooling in the overlying Breidavík Group (20 samples). Six dinoflagellate cyst biozones (DZ) could be defined (Verhoeven and Louwye, submitted). The changes in the assemblages proved to be independent to changes in bathymetry. Nutrient and prey dependent heterotrophic dinoflagellate cysts dominate during DZ1. During DZ2, an abrupt impoverishment in species diversity is observed and autotrophic species dominates now the assemblage. Slightly preceding the entrance of Pacific molluscs in the area in unit 14 of the Serripes Zone, heterotrophic species (unit 12/13) re-enter the area in DZ3. The entrance of a specific dinoflagellate cyst species, *Selenopemphix islandensis*, accompanied the entrance of Pacific molluscs (Verhoeven and Louwye, 2012) and could be linked to the shoaling of the Central American Seaway (CAS; Steph *et al.*, 2006), which pushed around 4.5Ma Pacific water through the northern situated Bering Strait (Verhoeven *et al.*, 2011). The entrance of cold, nutrient-rich Pacific water in the northern Atlantic induced again the presence of heterotrophic species in DZ3. This signal slightly precedes the migration wave of Pacific molluscs. It could be argued that the marked decrease and return of heterotrophic species does not relate to conditions of preservation, but may result from the loss of nutrients and prey organisms like diatoms. The top of DZ1 and the base of DZ3 reflect major changes in the palaeoceanography and span a period in which the PF may have been moved temporarily from the area. The first event situated at the top of DZ1 occurred in unit 4 halfway the *Tapes* Zone between 5 and 4.5Ma. The second event at the top of unit 12 around 4.5Ma has been linked to the shoaling of the CAS (see higher). Heterotrophic dinoflagellate cysts disappear almost completely from the area during the deposition of the Pleistocene Breidavík Group (DZ5-6). An assemblage dominated by autotrophic coldwater species comparable to the present-day assemblage of the area north of Iceland occurs from unit 10 in the Pleistocene Svarthamar Member around c. 1.7Ma ago.

References

- Steph, S., R. Tiedeman, M. Prange, J. Groeneveld, D. Nürnberg, L. Reuning, M. Schulz, G. Haug. 2006. Changes in Caribbean surface hydrography during the Pliocene shoaling of the Central American Seaway. *Paleoceanography* 21(4):4221. doi:10.1029/2004PA001092.
- Verhoeven K. and S. Louwye. 2012: *Selenopemphix islandensis* sp. nov.: a new organic-walled dinoflagellate cyst from the Lower Pliocene Tjörnes beds, northern Iceland. *Palynology* 36:10-25. (first published online: 2011). DOI 10.1080/01916122.2011.593573.
- Verhoeven K. and S. Louwye. (submitted). Palaeoenvironmental reconstruction with marine palynomorphs of the Plio-Pleistocene in Tjörnes, northern Iceland. *Palaeogeography, Palaeoclimatology, Palaeoecology*.