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Dinoflagellate cysts and pollen from the Tjörnes / Breidavik section: a biostratigraphical and palaeoclimatological study of Plio-Pleistocene sediments from northern Iceland.

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On the Tjörnes peninsula in northern Iceland, a unique sequence of Plio-Pleistocene shallow marine, continental and glacial sediments is exposed in cliffs near the Tjörnes Fracture Zone. The lowest part of the sequence consists of the more than 500 m thick Tjörnes beds of Pliocene age. In the overlying Breidavik Group, marine interglacial sediments are present together with lava flows and glacial deposits. In this unit, cycles 3, 4, 5 and 7 of the 14 glacial/interglacial cycles were examined for palynomorphs.

Sixty eight samples from the sedimentary succession of the Tjörnes beds and 20 samples from the overlying Breidavik Group were palynologicaly investigated for dinoflagellate cysts, pollen and spores. Despite the fact that half of the samples were barren or yielded a very low dinoflagellate cyst concentration (<25 cysts/g), the recovered assemblage holds valuable palaeoecological and biostratigraphical information.

The dinoflagellate cyst assemblage from the Tjörnes section reflects a Pliocene flora. Typical Miocene species disappearing at the Miocene - Pliocene boundary (5.33 Ma) such as Selenopemphix armageddonensis are not observed. The combination of the Pliocene record and the lack of typical Miocene species sets a maximum age for the base of the Tjörnes Beds at 5.33 Ma. The nearly continuous occurrence of Batiacasphaera minuta (highest occurrence at 3.8 Ma) and Operculodinium tegillatum (HO at 3.7 Ma) in the upper part of the Tjörnes beds (the Serripes mollusc zone) gives a minimum age of about 3.7 Ma for the top of this zone. These results indicate that the sediments of the Tjörnes beds are older and were deposited faster than previously thought, based on a K/Ar dating of the overlying basalt flows (Albertsson, 1976). In the Serripes zone, the new species Selenopemphix islandicus was recorded.

Observations of fragile heterotrophic cysts such as Barssidinium pliocenicum (HO at 2.66 Ma), Echinidinium euaxum (HO at 2.66 Ma), Selenopemphix dionaeacysta (HO at 2.4 to 2.6 Ma) and Trinovantedinium glorianum (HO 2.4 to 2.6 Ma) in the Hörgi Formation sets a minimum age of 2.7 Ma for the third glacial/interglacial cycle. In accordance to the age of the upper Tjörnes beds, this formation has to be older than thought in the present age model of the outcrop. (Símonarson and Eiríksson, 2008). The biostratigraphical analysis indicates an upper Piacenzian age for the Hörgi Formation, instead of the previous Gelasian age. The K/Ar dates of the Höskuldsvik lavas between the Tjörnes beds and the Breidavik Group (2.55+/-0.27Ma; 2.36+/-0.16Ma) appears to be too young.

Sea surface temperature reconstruction of the ocean water based on the warm/cold ratio of dinoflagellate cysts indicates higher values for the Tjörnes beds and the Hörgi Formation (3), compared to the colder water of the Svarthamar (5) and Torfhóll (7) Members. The appearance of pollen of temperate plants such as Ilex, Juglans and Tilia in the Tjörnes beds ánd the Hörgi Formation confirms the Pliocene age, and is in agreement with the dinoflagellate cyst biostratigraphy.

References:
Albertsson, K.J. 1976: K/Ar ages of Pliocene-Pleistocene glaciations in Iceland with special reference to the

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