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Reconstruction of Landscape Evolution Zones (LEZ) from laminated Eifel maar sediments of the last 60 000 years

Frank Sirocko
Institue for Geoscience, University of Mainz, Mainz, Germany (sirocko@uni-mainz.de)

Tephra, eolian dust, organic carbon, pollen and botanical macroremains from the dry maar lake structures auf Auel and Dehner are used to synthesize and define Landscape Evolution Zones (LEZ) for the Eifel during the last 60 000 years. LEZ 1-3 reiterate the established succession of vegetation during the Holocene and late glacial. The maximum of the last glaciation (LEZ 4: 14 700 – 23 000 b2k) was characterized by extremely sparse vegetation of some moss and characeae, however, characterized by annual activity of eolian dust. These sediments are generally devoid of clay and sand and reveal no indication of snow-meltwater events; accordingly, the Last Glacial Maximum (LGM) must have been extremely arid in central Europe. The sediments of the subsequent LEZ 5 from 23 000 – 28 500 b2k preserve however distinct layers of clay and coarse sand, which indicates running water with clay in suspension and ephemeral coarse grained fluvial sediment discharge; abundant Ranunculaceae macroremains (used for 14C dating), insects, moss and fungi sclerotia reflect a tundra environment during a time of frequent strong snow melt events. Total carbon content and Betula-Pinus pollen reach increased concentrations during all MIS 3 interstadials that occurred between 28 500 – 36 500 b2k (LEZ 6). Grass pollen and heliophytes indicate a steppe environment with scattered/patchy trees during the interstadials. The stadial phases of LEZ 6 reveal first activity of eolian dust deflation.
The opening of the early MIS 3 forested landscape to a steppe occurred with the LEZ 7 - LEZ 6 transition at 36 500 b2k. This is the time when modern man arrived in central Europe; possibly because the vegetation change must have favoured the spread of horse, which was the favoured hunting prey of the modern humans. Accordingly, we postulate that the migration of the modern humans into central Europe could have been mainly driven by climate and vegetation change. The LEZ 7 encompassing the time interval from 36 500 to 49 000 b2k was characterized by a boreal forest with high abundance of pine, birch, and also spruce during the interstadial events. Abundant charcoal fragments indicate that this taiga was under frequent drought stress. The most unexpected finding, but corroborated by all maar records studied, are the abundant thermophilous tree taxa characterizing the time interval 49 000 - 55 000 b2k, representing LEZ 8. The Greenland interstadials 13 and 14 were apparently the warmest part of MIS 3. The proceeding LEZ 9 from 55 000 – 60 000 b2k is also dominated by spruce, but thermophilous trees were only very rare. A continuously warm GI 13/14 appears plausible, because summer insolation was higher in the early MIS 3 than today, ice cover was low in Scandinavia and sea-surface temperatures of the North Atlantic were almost comparable to modern values during GI-14.