



Last glacial aeolian dynamics at the Titel loess plateau (Vojvodina, Serbia)

S.B. Marković (1), M.P. Bokhorst (2), B. Machalet (3,5,8), D. Štrbac (4), U. Hambach (3), B. Basarin (1), Z. Svirčev (6), T. Stevens (7), M. Frechen (8), and J. Vandenberghe (2)

(1) Chair of Physical Geography, Faculty of Natural Sciences, University of Novi Sad, Novi Sad, (zbir@im.ns.ac.yu), (2) Faculty of Earth and Life Sciences, Vrije Universiteit, De Boelelaan 1085, NL-1081 HV Amsterdam, The Netherlands, (3) Chair of Geomorphology, University of Bayreuth, 95440 Bayreuth, Germany, (4) Department of Natural & Applied Sciences, Bentley University, Waltham, MA 02452, USA, (5) GGA Institute, Stilleweg 2, 30655 Hannover, Germany, (6) Geographical Institute of SASA Jovan Cvijić, Dj. Jakšiča 9, 11000 Belgrade, Serbia, (7) Department of Biology and Ecology, Faculty of Natural Sciences, University of Novi Sad, Trg D. Obradovića 2, 21000 Novi Sad, Serbia, (8) Department of Geography, Royal Holloway, University of London, Egham, Surrey, TW20 0EX, UK

The Titel loess plateau (Vojvodina, Serbia) is situated at the confluence of the rivers Danube and Tisa, in the southeastern part of the Bačka subregion. Various phases of fluvial erosion have shaped the ellipsoid form of the plateau, which is characterized by steep slopes on the margins. The Titel loess plateau is a unique geomorphologic feature, further emphasising the wide diversity of the loess landforms. The plateau is an island of loess with a maximum length of about 16 km and a maximum width of 7.2 km. Thick loess deposits of between 35 and 55 m are intercalated by 5 main pedocomplexes likely deposited through the last 5 glacial/interglacial cycles. Steep loess cliffs expose several important sections for understanding climatic and environmental change during the middle and late Pleistocene in the region. The succession of palaeosols through the sequence strongly suggests a transition from humid interglacial climates in the middle Pleistocene, to drier interglacial climates in the late Pleistocene.

Past aeolian dynamics have been reconstructed using magnetic susceptibility, grain size, geochemical and malacological investigations by depth in the thick last glacial unit. Luminescence dating and magnetic susceptibility inter-profile correlation provide the chronological framework. Lower last glacial loess unit V-L1L2 is loosely cemented porous sandy loess, with occasional fine laminations and thin, fine sand beds. Identified malacofauna indicates very dry climatic conditions and poor steppe vegetation. It is hypothesized that while the last glacial vegetation cover is extremely sparse, significant sedimentation rates during the lower last glacial can be explained by the presence of a cyanobacterial crust. Protection of loess sediments from deflation by the presence of a cyanobacterial crust is observed at present in loess quarries (Ruma, Crvenka, Petrovaradin). The middle glacial was warmer and relatively moist, as indicated by an increase in clay content and magnetic susceptibility values in a weakly developed pedocomplex, V-L1S1. Loess sub-layers intercalated into V-L1S1 preserve evidence of episodes of abrupt cooling and aridification. In contrast with other European loess sites, the middle glacial pedocomplex is weakly developed at exposures on the Titel loess plateau. The uppermost late glacial loess stratum V-L1L1 shows low values of magnetic susceptibility and clay content, plus high values of carbonate content and the presence of a few frigidophilous and cold resistant snails, preserved in sediments laid down during the coldest palaeoclimatic interval of the last glacial period. Composite mollusc associations in loess unit V-L1L1 suggest a higher diversity of environments in comparison to those preserved in the V-L1L2 and V-L1S1 units.

In addition to climatic changes over interglacial-glacial and interstadial-stadial timescales, climate proxies (especially grain size) in the last glacial loess exhibit many abrupt fluctuations. Evidence of similar abrupt high frequency fluctuations during the last glacial period appear in loess throughout much of Eurasia. Without a detailed and precise chronological framework, provided by independent dating, as yet it is not possible to determine whether the variations recorded in the Titel plateau loess are related to widely documented events in the North Atlantic or independent regional or local depositional/environmental variations.

The intensity of deposition of coarser material during the relatively cold early last glacial exceeds that during the coldest last glacial maximum. This may be explainable via changes in general atmospheric circulation, as well as changes in the transportation and depositional regime of the Danube fluvial system. During the last glacial maximum,

extension of the ice sheets in northern Europe was greatest and may have redirected the penetration of Atlantic air masses to the east (e.g. Dodonov and Baiguzina, 1995). Model results presented in van Huissteden and Pollard (2003) indicate strong anticyclonal circulation over the Fennoscandian ice sheet and low wind intensity in the middle Danube Basin during the last glacial maximum, facilitating only localised loess transport. At the same time in the Danube Basin, the Alpine ice sheet played an important role in the fluvial regime, as well as in the production and transport of source material for latter aeolian deposition.