Climate Change in Southern South America. *Nature*, 345: 705-707.
TATUR A., DEL VALLE R. and AMOS A., 1994. Andes - Patragonian Steep: a late Pleistocene in the middle latitudes of the Sothern Hemisphere. IGCP, project 263: Termination of the Pleistocene in South America, Symp. Tierra del Fuego 26–28 March 1994, pp. 30-31.
TATUR A., DEL VALLE R. and AMOS A., 1996. Historia rozwoju jezior andyjskich i patagońskich (transekt Tronador - Cari Laufquen Grande). Spraw. z czynności i posiedzeń PAU, 60: 112-113.
TROMBOTO D., 1994. El permafrost Patagonico pasado. *Revista del Museo de Historia Natural de San Rafael (Mendoza)*, 12: 4.
VOLKHEIMER W., 1973. Observationes geologicas en el area de Inginiero Jacobacci y adyacencias (Provincia de Rio Negro). *Revista de la Asociation Geologica Argentina*, 28(1): 13-36.

Buried Floodplain Soils as Evidences of the Holocene Environmental Changes in Eastern Europe

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ABSTRACT. In the floodplains of rivers in the central part of Eastern Europe the sequences of buried soils were found. Soils were formed during the periods of low floods, when alluvial sedimentation stopped. Numerous ^{14}C and archaeological dates indicate the following intervals of intensive soil formation on the floodplains of Russian Plain: 6500–4500, 4000–2800, 2200–900 BP.

KEY WORDS: paleosols, Holocene, floodplain, radiocarbon dating, climate change.

Introduction

The floodplains are characterised by high dynamics of all landscape elements, including soils. In the Holocene, the processes of river valley development, accumulation of alluvium, changes in flood levels and intensity resulted in periodical destruction and burying of older soils and development of new ones (Mandel, 1992).

Methods and material studied

Methods of studying soil evolution and soil age for paleoenvironmental reconstructions included the analysis of soil profiles, soil chronosequences and soil catenas based on pedality, geomorphology and palynology, and using historical, radiocarbon and archaeological methods of dating (Ivanov and Alexandrovskiy, 1987; Alexandrovskiy, 1988).

In the floodplains within the basins of Volga, Oka, Moskva, and Dnieper rivers, the sequences of buried soils were found. Their age, determined by ^{14}C dating and archaeological findings, reaches 5000–6000 BP (Fig. 1).

Results and analyses

In the floodplain of the middle Oka, some multilayered (from Neolithic to the Medieval period) settlements are found. Their cultural deposits are mostly allocated to buried soils (Alexandrovskiy et al., 1987). The soils were formed during the time when the plain was not flooded and the sedimentation of alluvium was interrupted. Four main buried soils dated by radiocarbon and archeological methods were identified in the of in a series of principal sections through the multilayered floodplain settlements:

S1 Young alluvial soil of the floodplain, 300–100 BP;
S2 Early Iron age and Early Medieval cultural deposits, Luvisol (Grey forest soil), 2200–1000 BP;
S3 Bronze age, alluvial meadow soil, 4000–2800 BP;
S4 Neolithic cultural deposit, deep alluvial meadow soil, 6000–4500 BP.

When the Grey forest soil (S2) was formed, its profile developed downwards (illuvial Bt horizons were formed). The soil processes have worked on the underlying alluvial deposits, which caused their compaction and structural changes.

The rates of alluvial accumulation calculated from the layers thicknesses and dating have considerably varied and notably lowered during the formation of the Grey forest soil (S2).

The changes in hydrology of the floodplain led to multiple migrations of human settlements to the elevated positions and back.

Discussion and conclusion

In the floodplains of larger rivers as well as their smaller tributaries in the basins of Upper and Middle Volga, Oka, Moskva River, Upper Dnieper the sequences of buried soils were found. Soils were formed during the periods of low floods, when alluvial sedimentation stopped. Numerous C14 dates (Table 1) and archaeological evidences indicate the following intervals of intensive soil formation on the floodplains of Russian Plain: 6500–4500, 4000–3000, 2200–900, 300–0 BP (non-calibrated age). Second soil (S2) in many cases is a Luvisol (Grey Forest soil). Climate changes cause synchronous development of floodplain soils. However, both external and internal factors can desynchronize soil development in different parts of floodplains. Sometimes, the soils of different ages merge together (e.g. S2

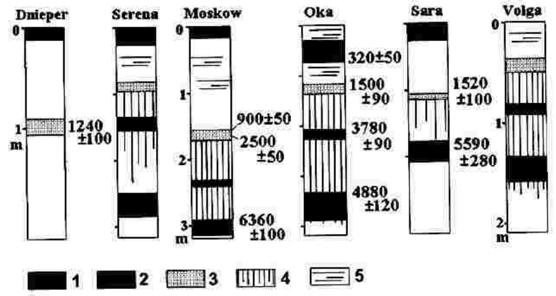

Fig. 1. Floodplain buried soils in the central part of Eastern Europe.
(1) Modern meadow soil, (2) Old meadow soil, (3) Luvisols, (4) Illuvial horizons of luvisols, (5) Modern alluvium.

No	Sample	Lab. code	^{14}C age (years BP)
1	Oka river, Nikitino site, S2 - Luvisol	IGAN -1212	1500 ± 90
2	S3 - Meadow soil	IGAN -1210	3780 ± 90
3	S4 - Meadow soil	IGAN -1209	4880 ± 120
4	Moscow, S2 - Luvisol	IGAN -2084	2500 ± 50
5	S4 - Meadow soil	IGAN -208 8	6360 ± 100
6	Sara river, S2 -Luvisol	IGAN -1089	1520 ± 170
7	S3 - Meadow soil	MGU -30	5590 ± 280

Tab. 1. Results of radiocarbon dating.

and S3 in the floodplain of Moskva River); in the other cases, they are clearly separated.

Because of progressive accumulation of alluvium many floodplains were not flooded any longer in the late, sometimes in the middle Holocene. In consequence soils of zonal types – Chernozems and Luvisols were formed on the floodplains. The periods of activation of alluvial sedimentation, which resulted in the burial of soils, are induced by climatic changes which occurred within the Holocene as well as increasing human impact. Deforestation and land cultivation in the river basins, which enhanced in the last 700–900 years, caused the increase of intensity and level of floods. Because of this on many floodplains of Central Russian Plain Luvisols (Grey Forest Soils and Albeluvisols) were buried under recent alluvium, on top of which weakly developed Fluvisols are formed.

References

ALEXANDROVSKIY A.L., 1988. Use of the methods of pedology for the historical geography. *Historická Geografie*, Praha, No. 27: 123-149.

ALEXANDROVSKIY A.L., GLASKO M.P. and FOLOMEEV B.A., 1987. Archaeologic-geographic investigation of floodplain buried soils as geochronological levels of the second part of the Holocene (In Russian). Proc. of Commission on Quaternary period study (Byull. Kom. Izuch. Chetvertichn. Perioda, Acad. nauk SSSR), 56, pp. 123-128.

IVANOV I.V. and ALEXANDROVSKIY A.L., 1987. Methods for the study of the evolution of soil. *Soviet Soil Sci.*, 19(3): 90-101.

MANDEL R.D., 1992. Soils and Holocene Landscapes Evolution in Central and Southwestern Kanzas: Implications for Archaeological Research. In: V.T. HOLIDAY (Editor), Soils in archaeology: landscape evolution and human occupation, Smithsonian Institution Press, pp. 41-100.

Climate-Related Fluvial Morphology in the Central Negev, Israel

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ABSTRACT. The relief structure of the valleys in the Central Negev is very similar. The sequences consist of terraces having the same relative height, similar pedological and sedimentological features, and the same numerical ages. Such similarity is attributable to a common history during the Pleistocene - Holocene. It is probable that the major climatic fluctuations in the Negev are related to global climatic changes, but an appreciable disparity occurs between the duration of a period with distinctive climatic conditions and that of the corresponding geomorphic processes. The majority of the changes of geomorphic processes (erosion ↔ accumulation) occurred during the transition between global climatic phases. However, even minor climatic fluctuations within climatic phases in a sensitive desert region can induce a major change in the reaction of the fluvial systems.

KEY WORDS: climate change, fluvial system, Pleistocene, Negev, Israel.

Introduction

The Central Negev area is the plateau rising 1000 m above sea level and dissected by ephemeral streams (wadis). The climate is arid with an annual rainfall of 50–100 mm. Three large erosion cirques (makhteshim) are also located in this area (Fig. 1). The Quaternary units were studied during the mapping projects at the scale 1:50,000 (Plakht, 1996). The mapping consists of the study of lithology of the Quaternary units, morphostratigraphy, numerical dating, pollen assemblage and the characteristic of paleosols.

The morphostratigraphic order of a terrace was determined due to its position in relation to the active channels, sedimentological characteristics of alluvium and pedological features. The alluvial composition and buried paleosols were used as indicators of climatic conditions.