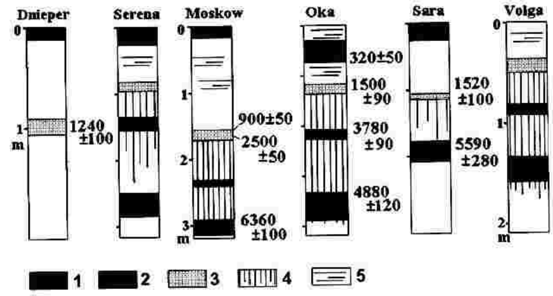

Fig. 1. Floodplain buried soils in the central part of Eastern Europe.
(1) Modern meadow soil, (2) Old meadow soil, (3) Luvisols, (4) Illuvial horizons of luvisols, (5) Modern alluvium.

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.

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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.

Forty-five pollen samples were collected from the terrace sections and recent channel. A distinct pollen assemblage was defined in each terrace, permitting reconstruction of the previous flora and the climatic conditions during its deposition. For absolute age determination the radiothermoluminescent (RTL) method was used. Thirty samples from different terraces and loess sections were collected. Natural quartz is employed as a thermoluminescent paleodosimeter.

The aim of this study is to evaluate the main factors that determined the similarity in the relief structure and development of the valleys in the Pleistocene.

Fluvial stratigraphy and chronology

The Holocene alluvium composing *flood plain and terrace I* (3–4 m above channel) is relatively homogeneous and consists mainly of pebbles interbedded with thin bands of sand. The pollen spectra show true desert flora composed almost entirely of Chenopodiaceae (Plakht, 1995) reflecting arid and extremely arid climate.

The alluvium of *terrace II* (5–6 m) contains a large amount of fine material, mostly of aeolian origin. It contains two to three buried pedogenic calcic horizons comprising of well-developed carbonate nodules. The RTL age of buried soils is ranged from 27 ± 7 to 36 ± 7 ka BP. Pollen spectra display prevalent steppe vegetation under a semi-arid climate (Chenopodiaceae >> Compositae) with an assumed annual precipitation exceeding 200–250 mm (Plakht, 1995).

The mainly pebble alluvium of *terrace III* (8–10 m) contains buried gypsiferous paleosol. The RTL age ranges between 48 ± 12 ka and 60 ± 12 ka BP. An assemblage of true desert and steppe elements in pollen spectra indicates an arid climate (Compositae ≈ Chenopodiaceae), although milder than in the Holocene.

The next chronological unit, 3–4 m thick, is of loessal nature. This unit does not form a regional morphostratigraphic unit. It contains a calcic pedogenic horizon. The RTL age is in the range of 62 ± 12 ka to 72 ± 15 ka BP (Plakht, 1995).

The alluvium of *terrace IV* (13–15 m) is composed of interbedded pebbles and sandy-loamy layers. It contains one or two horizons of buried calcic paleosol with carbonate nodules. The RTL age ranges from 101 ± 21 ka to 150 ± 37 ka BP. Pollen spectra reflect semi-arid period with dry steppe vegetation (Compositae > Chenopodiaceae), and reflecting a climate drier than during uppermost Pleistocene.

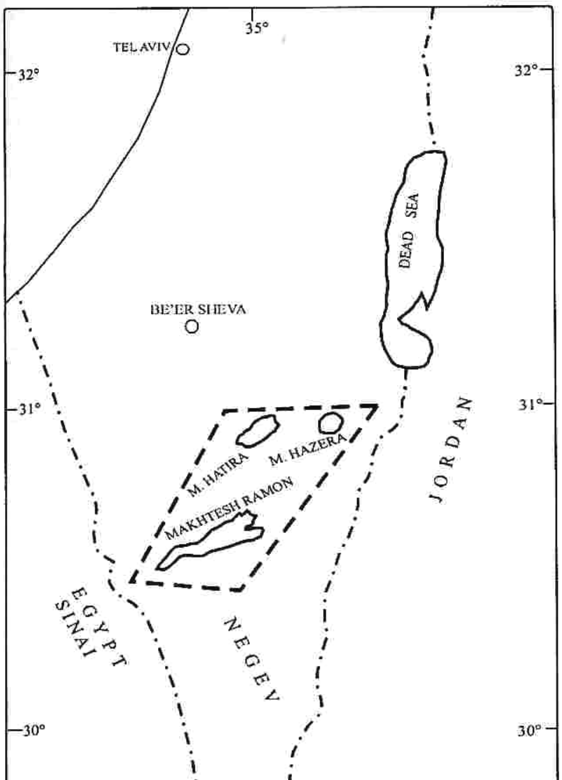

Fig. 1. Study area.

Discussion and conclusions

Based on the climatic model of the development of geomorphic processes, it was noted (Goldberg, 1986; Zilberman, 1992) that there is no direct correlation between climatic fluctuations in the Negev and Europe. During the peak of the last glacial (approximately 18 ka BP) erosion prevailed in the Negev (Zilberman, 1992), whereas the early and last stages of this glacial were characterized by dominant accumulative process. A dry

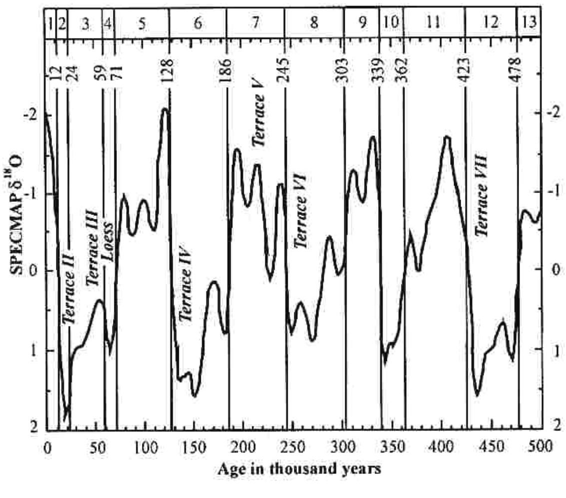

Fig. 2. Graph showing position of Quaternary units in Central Negev on a scale of global climate change based on marine stable isotope records. The stacked smoothed $\delta^{18}O$ record from SPECMAP is plotted versus age (Imbrie et al., 1984). The $\delta^{18}O$ values are expressed as standard deviation unit about a mean value of zero. Typical glacial-interglacial differences range between 1.5 and 2.0 per mil. The standard Isotope Stages are identified at the top of the graph with interglacial stages denoted by odd numbers and glacial stages by even numbers. Isotope Stage boundaries with SPECMAP ages are identified as thin vertical lines.

climate at 18 ka ago is also expressed in pollen diagrams from the Hula basin in northern Israel (Horowitz, 1979). Another example of such discordance is the Early Würm loess unit dated as 62–72 ka BP. During this period, erosion prevailed in the Central Negev. In addition to this indicated a good correlation between climatic curves for Israel and oxygen isotope curves obtained from the northern Atlantic Ocean (Horowitz, 1992). Although the major climatic fluctuations in the Negev are related to global climatic changes, appreciable disparities occur between the duration of a period with distinctive climatic conditions and the duration of corresponding geomorphic processes. The study of continuous sequences permitted the conclusion (Weinstein-Evron, 1983) that the main climatic phases, both glacial and interglacial, were interrupted by episodes of different duration, characterized by opposite climate. Thus, the strongly deterministic climatic model, which explains a change in erosion-accumulative processes, and which is based on direct correlation with the global climatic scale, does not work in a simple form.

Phases of alluvial accumulation (Fig. 2) coincide with arid (*terraces I, III*) as well as with semi-arid periods (*terraces II, IV*). However, analysis of pollen data shows that the degree of aridity during the periods of accumulation was not as severe as during periods of strong erosion. The present-day hyper-arid spectra are characterized by absolute prevalence of Chenopodiaceae, whereas the alluvium of *terrace III* contains spectra with an almost equal content of true desert Chenopodiaceae and dry steppe Compositae + *Artemisia* elements. Episodes of accumulation within arid periods could reflect the slightly more humid periods. Therefore, low-amplitude climatic fluctuations within climatic phases in a sensitive desert region can induce a major reaction of the fluvial systems and can lead to the changing in the regime of alluvial processes (erosion ↔ accumulation).

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Sedimentary Deposits of Bohemian Forest Lakes as an Archive of Pollution by Metals

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ABSTRACT. Chronology of metal pollution was studied in 0.3 to 1.3 m long sediment cores collected from lakes in Bohemian Forest (SW Bohemia). The ^{210}Pb and ^{14}C datings provide a reliable chronology of cores extending back to above 6500 BP. The sediments have recorded both regional and local atmospheric pollution caused by smelting of metals, for Pb since about 2810 BP. Concentrations of Pb, Cu, Bi, and As increased around 2000 BP, 1400 BP and 1050 BP. The pollution produced by smelting was much more pronounced in the 14th and 16th century AD, when concentrations of Pb exceeded natural by a factor of 7–8. The Middle Age maxima resulted from pollution by metal smelting in the wider surroundings of the lakes and are probably mostly Bohemian origin.

KEY WORDS: palaeolimnology, metal pollution, Bohemian Forest.

Introduction

The profiles of lake sediments (Norton, 1986; Renberg et al., 1994), peat (Lee et Tallis, 1973; Shotyk et al., 1998) and ice (Hong et al., 1994; Hong et al., 1996) contain records concerning not only the changes in the vegetation and climate but also the past local and regional variations in the atmospheric deposition of some trace elements. The changes can be studied by the trace element analysis of the sediments. The present work survey results of the first study of the sediment profiles from the Bohemian Forest lakes.

Methods

With the help of a home-made piston corer with a diameter of 0.06 m, three profiles were collected in the Černé Lake, two