MEGAFLOODS OF THE LATE PLENIGLACIAL - YOUNGER DRYAS IN THE SOUTHERN RUSSIAN PLAIN

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Extreme floods at the rivers fed by the melt water from glaciers or glacial lakes are well studied in the past periglacial areas. Palaeohydrology of the rivers with no source of glacial melt water in cold climates with widespread permafrost attracted less attention, though such rivers drained an area over $30x10^6$ km^2 in the Northern hemisphere at the termination of the Last Glaciation. The periglacial zone with continuous permafrost and low soil permeability spread then over the Russian Plain and the West Siberian Plain as far south as 49˚N. The relicts of large palaeochannels are found on the lower levels of river terraces and on the flood plains all over the former periglacial zone. The majority of these palaeochannels had a meandering pattern. Their widths exceeded those of the recent channels up to 15 times.

Based on the detail coring of the sediments filling in several palaeochannels, the geometry of cross-sections of these palaeochannels was reconstructed. Calculations with Chezy-Manning formula for the palaeochannels of the Protva River (the Oka River basin, mixed broadleaved-coniferous forest zone), the Seim River (the Dnieper River basin, forest-steppe zone), and the Khoper River (the Don River basin, steppe zone) show that the reconstructed megafloods were up to 14 times greater than the modern ones (Table). All these large palaeorivers were active in the Late Pleniglacial. The beginning of filling of the Protva River large channel with sediments occurred app. 12 700±110 yrs BP (Ki-7312). The large channel of the Khoper River was active 14 430±110 yrs BP (Ki-7694). Its filling has begun about 12 000 yrs BP (11 900±120 yrs BP, Ki-5305; 11 325±120 yrs BP, Ki-7680). The large palaeochannels of the Seim and Svapa Rivers were abandoned about 14 000 yrs BP (13 800±85 yrs BP, Ki-6984; 14 030±70 yrs BP, Ki-6997; 13 510±85 yrs BP, Ki-6991). All the dates are given as uncalibrated ^{14}C years.

Table. Extreme flood discharges at several Late Pleniglacial rivers of the Russian Plain.

River	Protva River	Seim River	Khoper River
Morpho-hydrological characteristics	mod/palaeo	mod/palaeo	mod/palaeo
Basin area (km^2)	2170/2170	10700/10700	19100/19100
Channel width (m)	80/180	60/1000	60/1400
Meander wavelength (m)	760/1600	780/5600	720/5000
Longitudinal slope	$4.1\ 10^{-4}/3.24\ 10^{-4}$	$1.3\ 10^{-4}/7.5\ 10^{-5}$	$6.3\ 10^{-4}/1.54\ 10^{-4}$
Mean discharge ($m^3\ s^{-1}$)	11.6/240	37.1/490	67.8/450
Mean maximum discharge ($m^3\ s^{-1}$)	250/3100	575/6400	991/5800
Extreme discharge ($m^3\ s^{-1}$)	507/7000	1920/14500	2910/13200

The next stage of megafloods is related to the Younger Dryas cold interval. The Khoper River channel width was then 150-200 m, still exceeding the present channel parameters. The mean maximum discharge in that channel was about 2000 $m^3\ s^{-1}$, two-fold a modern flood. These meanders were abandoned by the end of the Preboreal (9420±90 yrs BP, Ki-7693).

The main cause of megafloods formation with the discharges 6-14 times more than recent ones were periglacial conditions with deep permafrost and very sparse vegetation. The transformation of the large periglacial channels into significantly smaller Holocene channels occurred mainly due to the degradation of permafrost, decrease in the winter precipitation (snowfall) and surface runoff.