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REGIMES OF MONO -AND POLIZONAL LARGE RIVERS IN THE QUATERNARY

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The large rivers of the world exist over large continents, created over extensive tectonics plates. Depending on the tectonic activity these blocks are elevated to various altitudes. Especially active are the margins of continental plates, where young mountain chains are still rising, forming the main watershed of the continents. Depending on the direction of mountain chains and width of flat platforms on the mountain foreland there is more or less space for the development of large river system (fig.1). The direction of main river remains in various relationship with latitudinal pattern of climatic - hydrological zones. A various participation of mountain ranges and different climatic vertical belts on the contrary causes vertical differenciation in runoff. Taking all these diversities into account we may distinguish three main types among the existing large rivers and their catchments: monozonal rivers, polyzonal rivers with main vertical component, polyzonal rivers with main zonal component (fig.2).

Monozonal rivers are characterised by more or less uniform precipitation and runoff regime over the whole catchment due to their location in one climatic zone. Most of such catchment is located in one vertical belt and main axis of the river has W-E direction. To this group belong Congo, Orinoco, Amazon (excluding uppermost reach), as well Volga, St.Laurence, Yukon and others. The regime of such rivers reflects the annual rainfall pattern characteristic for the climatic zone.

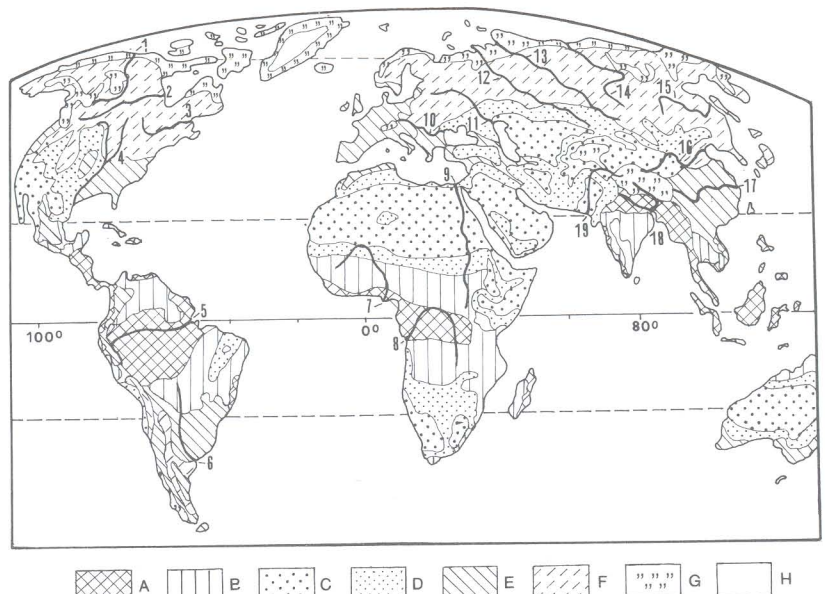

Figure 1. Large rivers on the phone of climate vegetation geomorphic zones of the world. A. Tropical - humid, B - tropical - subhumid, C - desert, D - semidesert and steppe, E - temperate - oceanic and mediterranean, F - temperate continental, G - polar - tundra, H - ice sheet.

Large rivers: 1. Mackenzie, 2. Saskatchewan, 3. Mississippi, 4. St. Laurence, 5. Amazon, 6. Parana, 7. Niger, 8. Congo, 9. Nile, 10. Danube, 11. Volga, 12. Ob, 13. Yenisey, 14. Lena, 15. Amur, 16. Hoang-ho, 17. Yang-Tse, 18. Brahmaputra and Ganga, 19. Indus.

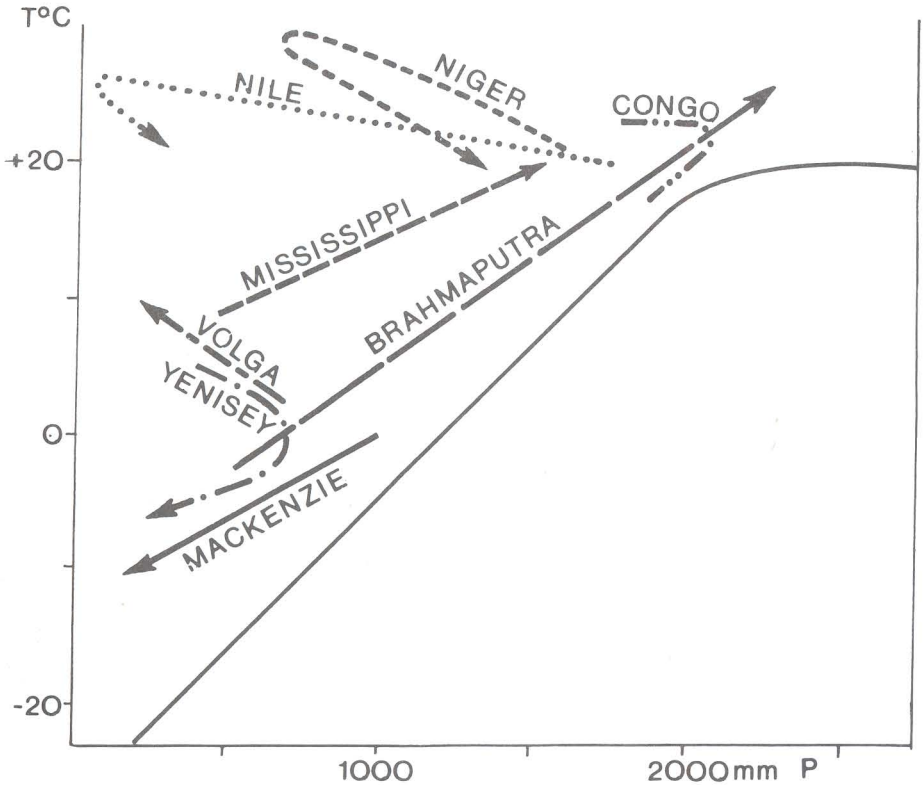

Figure 2. Position of the longitudinal profile of large polyzonal rivers on the climatic diagram (mean temperature and annual precipitation) indicating change of the regime downstream.

Polizonal rivers with main vertical component reflect, great vertical variety in runoffregime and may be supplied by rainwaters as well by meltwaters from snow and glaciers. Most frequently the variation in discharges on their whole length are controlled by floods originating in the mountains located in the same climatic zone: monsoonal (Ganga), arid (Amu Daria and Syr-Daria), temperate (Danube, Mississippi), boreal-continental (Lena).

The most complex regime have the rivers passing various climatics zones (also with mountain chains), characterised by allochtonous fluvial regime. Among them are the rivers flowing from the humid tropics to the arid zone (Nile), from arid to humid (Yang-Tse, Brahmaputra, Amur), rivers with several changes on their course (Niger, Indus) as well as rivers flowing to the Arctic Ocean with changing length of freezing season and melting time along their course (Meckenzie, Ob, Yenisey).

During the Quaternary we observe general latitudinal shift of climatic- vegetation belt, combined with fluctuation of humidity, combined with expansions and decays of extensive ice sheets (CLIMAP 1976, Frenzel et al, 1992). These changes created substancial changes in the fluvial regimes of monozonal and polyzonal rivers, combined with principal changes of river network (Schumm 1965, Starkel 1979, 1989, 1990, Starkel et al. 1991, Gregory et al 1995; fig 3)

In the case of monozonal rivers in the lower latitudes it was registered the declain in the runoff during could phase and rise of river discharge in the Lateglacial and early Holocene. Much greater were the changes in the tundra or steppe vegetation and water circulation was controlled for the existance of permafrost.

The polyzonal rivers with vertical component were characterised by lowering of vertical climatic zones, including snow line and by expansion of glaciers. This is well visible in the Danube valley as well in the rivers draining the Tibetian Plateau or other Asian mountains.

The most distinct changes were registered in the polizonal catchments folloxing the N-S direction. The shift of forest (or even their total disseaperance, expansion of permafrost, shortening of ice –free

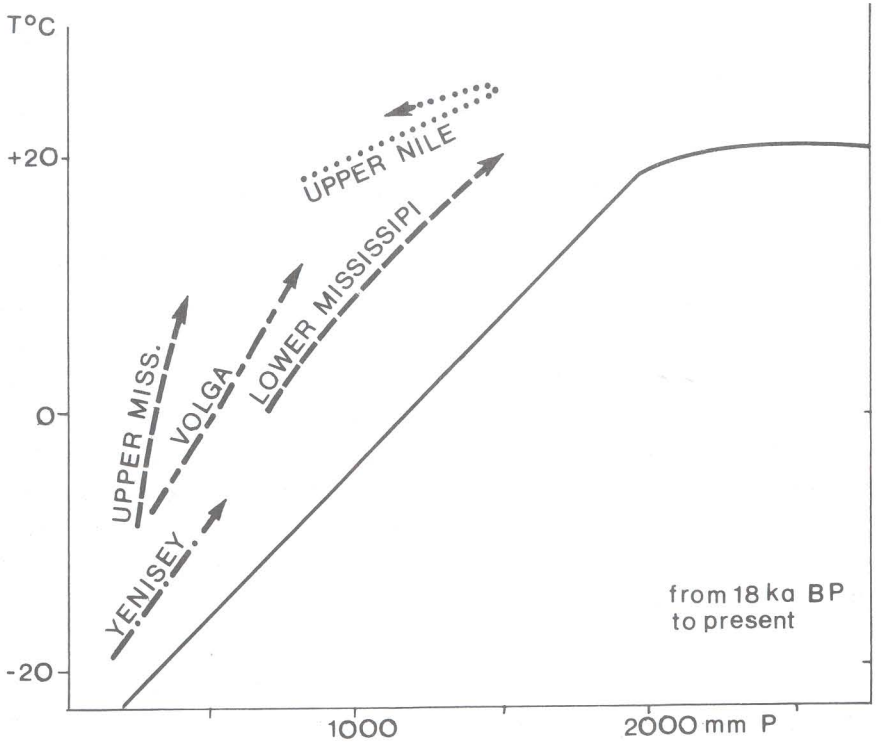

Figure 3. Change of the position of selected great rivers during last 18-ka (based on Starkel 1990).

season caused a general change to aggradation and formation of braided channel pattern (Siberian rivers). Rivers flowing to the south like Mississippi or Volga carried meltwaters to the south extending their river channels. The others like Pechora, Vistula or Saskatchewan were blocked by ice sheet. During the deglaciation a new river network started to develop and reaches of various origine have been incorporated into new system (Starkel 1979, Teller 1990). The rivers like Mackenzie or St. Laurence still preserve the rivers courses inherited from the time of glaciation and the size of their former channels and floodplains indicate thet these are underfit in relation to present-day discharges and forms (Dury 1977, Gregory et al. Eds.1995).

The rhytmics fluctuations of climatic changes during the Quaternary are reflected in the sequence of forms and fluvial sediments along large rivers (Starkel 1990). Their course along the valley floors of the large rivers varies depending on the character of changes in the monozonal or polizonal rivers.

Therefore studing the fluvial history of large river valleys and reconstructing runoff regime in their longitudinal profiles we should consider the polyzonal character of the regime and the changing position of the catchment in the zonal structure of the globe. But we should remember on the simultaneous tectonic tendencies, which may cause different tendencies, either towards downcutting or towards aggradation.

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