

A GIS-model of the basement-cover correlation in the Poozerye area of the Polotsk-Kurzeme fault belt in Belarus

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One of the major zones of weakness of the lithosphere in western Baltica is the Polotsk-Kurzeme zone (PKZ) (Fig. 1 in Garetsky et al abstract, *this volume*). It is important that this zone, even though formed in the Early Precambrian, is still active and creates many industrial and ecological problems. The Proterozoic crystalline basement is covered by Ripheian, Vendian, Cambrian, Ordovician, Silurian, Devonian and Quaternary sediments.

The main aim of this study is to correlate geological surfaces of various ages and the present-day landforms above the Polotsk-Kurzeme zone. The instrument of the study has been the geographical information systems (GIS), which allows to visualize the landforms and various structural surfaces (Karabanov et al., 2005), as well as to compile maps of correlation coefficients between these features. The key area of this study is the Poozerye area in the Polotsk-Kurzeme fault belt in Belarus (Fig. 1).

The GIS-models of correlation coefficients have been performed using the software of the geographical informational systems Arc View 3.2 and ArcGis 9.0 (ESRI, USA). The project “GIS-models of Correlation Coefficients of the Poozerye area of the Polotsk-Kurzeme fault belt in Belarus” consists of the following auxiliary vectorial layers (framed in ArcGis 9.0 environment): topography (rivers, lakes, settlements, borders of the Poozerye); digital relief model (isolines, three-dimensional model of landforms), depths to the structural surfaces (basement, the base of pre-Quaternary sediments, top surfaces of the morainic and intermorainic beds), and the position of the PKZ fault system.

The GIS-model of the basement-cover correlation has been made using Arc View 3.2 software (“Spatial.CalCorrCoefbyMovingWindow” script, <http://arcscripts.esri.com>). The correlation between the structural surfaces has been obtained with the moving window (Dixon et al., 1969). The steps of averaging of 10 and 5 km for each pair have been computerized.

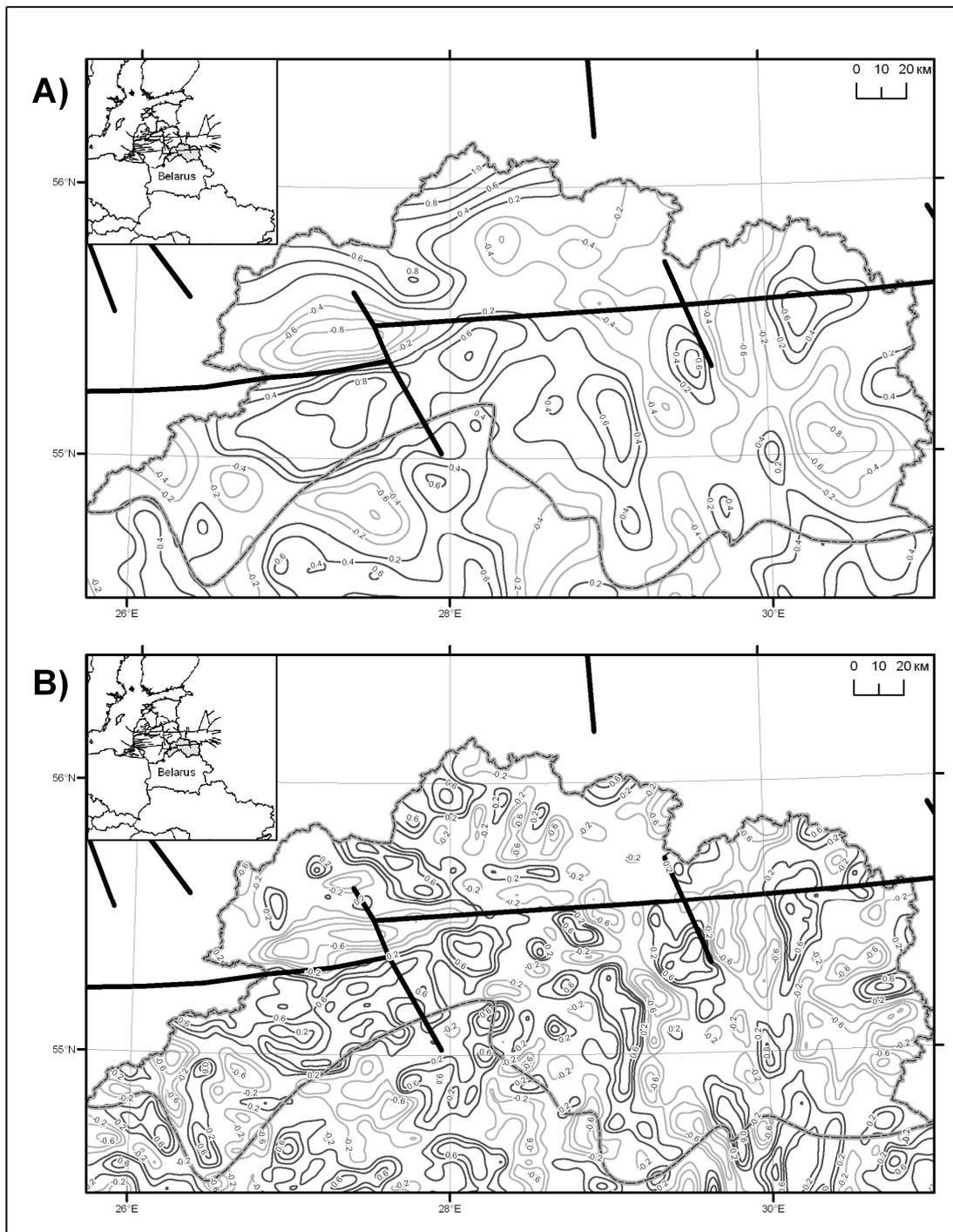


Fig. 1. Maps of correlation coefficients between the basement surface and the present landforms surface of the Poozerye Area of the PKZ in Belarus
(A – of 10 km step of averaging, B – of 5 km step of averaging)
Black solid lines indicate the faults bounding the southern PKZ (after Garetsky et al., 2004); grey dashed line is the southern border of the Poozerye Area (after National atlas of Belarus, 2002)

According to the methodology, the program divides territory into squares which size depends on step of averaging (e.g. if the step is 10 km, the squares are 10×10 km). Then the script calculates values of the correlation coefficients of each pair of squares according to the Pearson method of linear correlation. Finally, using interpolation function of Spatial Analyst of ArcGis 9.0, the series of the maps of correlation coefficients between all the structural complexes in the Poozerye area have been developed (Fig. 1). It is noteworthy that the faults bounding the southern PKZ in Belarus, more often than not, have emerged as valleys on the pre-Quaternary surface, on the top surfaces of morainic and intermorainic beds, and also coincide with the location of rivers. This is particularly clear for the western part of the Poozerye area, because there the basement surface is not very deep (40-550 meters below present landforms) as compared with its eastern part where the basement occurs at 763 to 1825 m below the present landforms.

The application of the modern GIS-technologies in study of the Polotsk-Kurzeme zone allows evaluating the inheritance of the Precambrian tectonics in the Phanerozoic and recent evolution of the crust. The obtained results could serve as a base for geological and geomorphological mapping as well as for a human impact assessment and prevention of natural hazards.

References

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