VARYING PRESSURES OF THE ICE SHEETS AS A FACTOR OF THE PLEISTOCENE ACTIVITY OF THE POLOTSK-KURZEME AND THE SMALAND-BLEKINGE DEFORMATION ZONES

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Continental topography is at the interface of processes taking place at depth in the Earth, at Earth's surface, and in the atmosphere above it. During the last 20 Ma plate-tectonic and other geodynamic processes in the Earth's interior have caused many changes in the Earth's surface topography. The impact of Solid-Earth processes on surface topography at plate boundaries has been known for several decades, but their influence in intraplate areas is only just being appreciated. One of the examples of the influence of processes in the deep Earth to Earth' surface is the correlation between faults of the crystalline basement and topolineaments.

Topographical maps, airphotos and satellite images suggest a remarkable linear arrangement of landforms here called lineaments. Those lineaments are often related to fault zones of the crystalline basement. A good example of this relationship is the Polotsk-Kurzeme Deformation Zone (PKDZ), which extends from Moscow across the northern part of Belarus, to Latvia and Lithuania and its possible continuation across the Baltic Sea into the Småland-Blekinge Deformation Zone (SBDZ) and Bornholm Island (Fig. 1). Those from one of the numerous fault zones in the Precambrian crust of the East European Craton (EEC), which was formed at ca. 1.5-1.4 Ga. On the surface, the PKDZ and the SBDZ are reflected as linear landforms and by hydrography. The character of the Quaternary sediments (glaciodislocations, declining glacial and interglacial layers, changing thickness of sediments), seismic activity, all indicate neotectonic and recent movements along these lineaments.

The influence of Mesoproterozoic faulting on the Paleozoic, Mesozoic, Cenozoic and recent evolutions of the Precambrian crust has been assessed using 3D reconstructions of paleosurfaces, GIS (=Geographical Information Systems) -models of basement-cover correlation and topolineaments identification (Fig. 2 and 5). The key target areas of this study have been the Polotsk part of the PKDZ in northern Belarus and the eastern part of the SBDZ in southeastern Sweden (Figure 1). Geologically the key areas are sufficiently different. The crystalline basement in the Polotsk area lies under the mostly thick sedimentary cover. The present topography was formed by accumulation activity of the repeated Pleistocene glaciations. Only the thin layer of the Quaternary deposit covers the crystalline basement surface in the eastern part of the SBDZ area. There are a lot of bedrock outcrops. The present topography was shaped by the melted dead ice of the last Scandinavian Ice Sheet.

The 3D upper paleosurfaces of the crystalline basement, the Ectasian-Stenian, Ediacaran, Ordovician, Devonian and Quaternary sedimentary deposits and the present landform surface for the Polotsk key area as well as the 3D upper paleosurfaces of the crystalline basement and the present landform surface for the eastern part of the SBDZ key area have been performed with ArcGis 9.1 software. A series of maps showing correlation coefficients between the upper paleosurface of the crystalline basement and all the various Phanerozoic deposits has been produced for the key target areas. We have also profiled the Quaternary deposits in the Polotsk area (Fig. 3 and 4).

As a result of the study, two main stages of activity of the PKDZ have been identified in the Polotsk area. In the Mesoproterozoic, the major EW- and linked NS-trending fault systems

developed in conjunction with orogenic processes at the southwestern margin of the EEC. In the Cenozoic, the activity of this belt was caused by both neotectonics and varying pressures of the ice sheets with attendant Pleistocene deformation of the sedimentary cover within the Polotsk area. In the eastern part of the SBDZ key area the Mesoproterozoic-Phanerozoic activity has been identified.

In consequence, we find that the application of modern GIS-technologies to the study of the PKDZ and the SBDZ allows evaluating the effect of the Precambrian tectonics on the Phanerozoic and recent evolutions of the crust.

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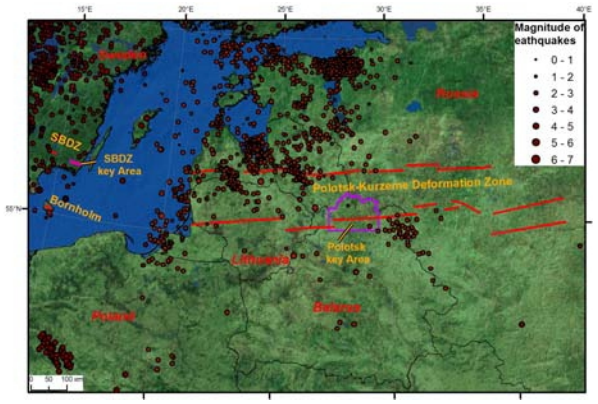

Figure 1. ***The seismic activity in the region of the PKDZ and the SBDZ***

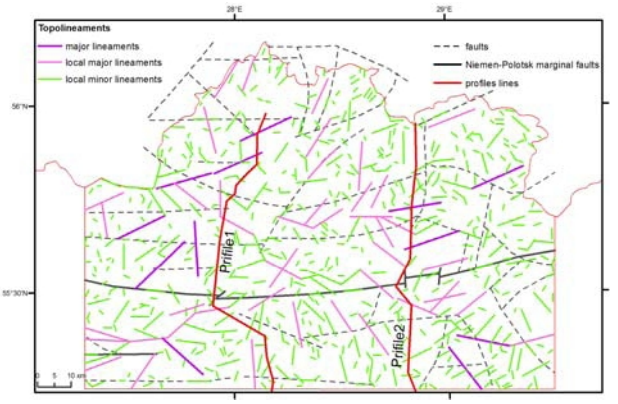

Figure 2. ***Faults of the PKDZ and topolineaments in the Polotsk area. Location of the geological profiles***

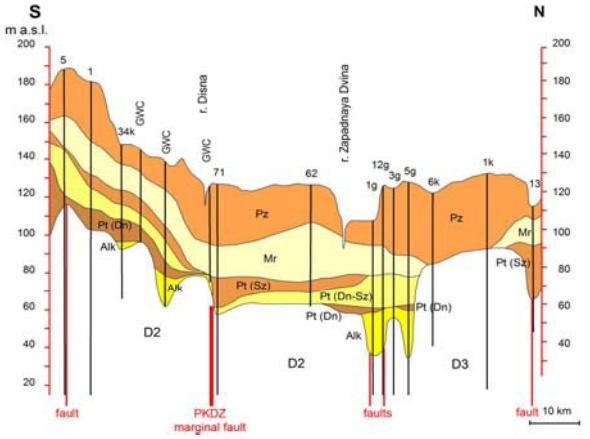

Figure 3. ***Profile 1***

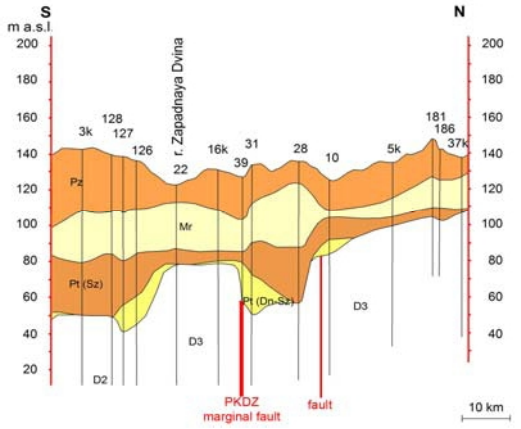

Figure 4. ***Profile 2***

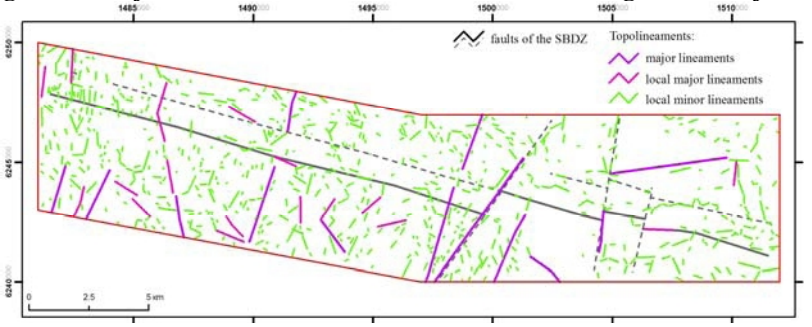

Figure 5. ***Faults of the SBDZ and topolineaments in the eastern part of the SBDZ area***