Igneous processes, in particular intensive volcanism and often associated with in seismic activity, are among the most spectacular, although also hazardous expressions of the lithosphere plate tectonics. Middle Europe north of the Carpathian arc, is a tectonically quite region, avoid of this type of phenomena. It is regarded also to be such in a geological past during whole the Phanerozoic (since ca. 540 Ma until recent time). The current project aims to demonstrate, that for the time when the region between Baltic Sea and Lublin Basin was the Variscan foreland, such characteristic is not valid. The main goal of the project is to prove a presence in this region of the large Lublin-Baltic Carboniferous Igneous Province (LBCIP), reveal its evolution, characteristics and territorial extend. Therefore, we postulate that within the region of more than 100.000 km^2 the numerous igneous intrusions, effusive rocks, piroclastics and vulcaniclastics are not local, isolated and independent phenomena, but are associated and of common origin. This thesis is validated by the results of pilot studies, during which we identified more than 80 boreholes piercing rocks of igneous origin. These are rocks of coherent, alkaline type, developed during early Carboniferous ca. (350-340 Ma). Majority of these rocks were have never been studied, and in many cases even their presence has not been anticipated by scientific society. Moreover, this project aims to define impact of the igneous activity on development of sedimentary basins. This impact is related to elevated geothermal gradient and hot fluid migration, which affects both diagenesis of sedimentary rocks and petroleum potential of this region. It is worth notice that study of the LBCIP remains a circumstantial trial due to the fact that only small part of initial igneous products were preserved till recent times, while majority of them were eroded during the late Variscan uplift and denudation. Moreover, the remains of the original LBCIP are recently buried deep beneath younger sedimentary rocks.

Within the current project the characteristics and evolution of the LBCIP shall be systematically studied with use of broad spectrum of complementary, up-to-date analytical methods. Geochemical, petrological and mineralogical analysis and isotope geochemistry (Nd, Sr, Pb) will be applied to define affinity of the individual igneous bodies. Analysis of chemical composition of minerals (EPMA), trace elements in clinopyroxene and feldspars (LA-ICP-MS), will define petrological character of the postulated LBCIP, estimate the melt differentiation paths of a series of igneous rock. Geochemical modeling will be applied for determination of the mantle source characteristics, scale of partial melting of the mantle and differentiation of the alkaline melts induced by fractional crystallization and mixing processes, and possible crustal assimilation. Heavy minerals spectrum and geochemical analysis will allow to determine if detrital components of igneous origin within the Carboniferous sediments deposited west of the study area originated from erosion of the LBCIP. Among the key research methods applied to study the LBCIP shall be the high resolution geochronological tools, such as the U-Pb dating of zircon and baddeleyite with SHRIMP IIe/MC tool and the $^{40}Ar/^{39}Ar$ dating of bulk samples. This will be supported with K/Ar dating, allowing to preliminary differentiation between Carboniferous and Neoproterozoic igneous rocks. Geochronological studies shall define precisely age of the individual igneous bodies, and therefore define the timing of igneous processes, including the phases of its intensification. The lateral extend of the LBCIP will be determined by presence of geochemically associated igneous rocks of coeval age in borehole sections, supported with geophysical studies, in particular analysis of magnetic anomalies and analysis of seismic data.

The proposed research project shall have broad impact on the Earth Sciences. The concept of a new large igneous province, if properly proofed, would itself be an uncommon case of recent discovery of large geological unit. The results of the project will impact understanding of the lithospheric structure of the western East European Craton, and the tectonic interrelations between Variscan orogen and its foreland plate. The concept of the LBCIP shall impact understanding of the post-depositional history of sedimentary basins of the study area, as well as its petroleum potential. Since the igneous activity discussed here is of the alkaline character, the results of the study will be useful for determination of zones enriched in the Nb-Ta and rare earth elements (REE), being critical raw materials. Moreover, it will affect understanding of distribution of geothermal removable energy resources.