Suwalki Anorthosite Massif (SAM) together with norite-anorthosite Sejny Intrusion (SI), are located within 200 km long magmatic belt elongated on E-W direction, called the Mazury Complex (NE Poland). A crystalline basement in the area is covered with a thick younger, sedimentary cover (550-1300m ppm) that are dipping gently in the SW direction towards the East European Craton border. The history of the development of SAM is very complex, and its internal structure is still poorly understood due to the unavailability of the total magmatic body. Its shape and the overall geological structure is known due to geophysical research and numerous deep boreholes located irregularly within the massif. The information received shows that SAM is made up of massive type type anorthosites, surrounded by a rim of norite rocks with transition to gabbronorites and dioritoids. Surrounded area is built by the huge amount of acidic and intermediate rock masses of the composition of mangerite (monzonite, monzodiorite to quartz monzonite) and granite (rapakivi type) belonging to well known AMCG. rock facies in Proterozoic Era. SAM is related with a large negative magnetic anomaly (-1700 nT). It is believed that it is the result of reverse magnetization of anorthosite rocks. Previous geological and drilling studies have been focused primarily on exploration of iron and titanium ores aspects within the SAM (eg. Krzemianka, Udryn and Jeleniewo fields). Much less research has been devoted to regional, geological analysis of the whole SAM massif. The previous age determinations, detailed petrological studies of the massif and its surroundings have allowed to document Mezoproterozoic age of magmatism and iron-titanium mineralization with Fe-Cu-Co-Ni sulphides in the Suwalki massif by radigenic method Re-Os (NTIMS spectrometer) on sulphides and magnetite distributed in anorthosite (age of 1.59 billion years) and by classical U-Pb method on zircons from rapakivi type granite (age 1.52 billion years). Performed structural and kinematic analysis of crystalline rocks from the SAM. resulted in the recognition shear and ductile zones and allow to demonstrate their role in emplacemet and geometry of the ore bodies of "Krzemianka" and "Udryn"reserves. Despite new petrological and structural studies done in recent years, SAM as a whole geological object is still hardly known, with not fully recognized spatial structure and the history of creation. So far there are better known an areas of Krzemianka and Udryn, where iron and titanium deposits occur, but the rest of 90% of the massif was not fully diagnosed, the course of rock complexes limits inside the massif and the depth and shape of a large magmatic SAM body. Only fragmentary tectonics of the massif.has also been known. Common hydrothermal veins filling cracks and discontinuity zone and pegmatite, applite and quartz veins have not been comprehensively studied by geochemical, mineralogical methods and so far we do not know their age.

Therefore, the main objective of this research project is to develop and interpret geological-geophysical spatial structure of magmatic anorthosite massif (SAM), as well as restoration of physical and chemical magmatic processes, igneous rock evolution and mechanisms of their emplacement in the upper crust of the Earth. The partial objectives will be: (1) developing three-dimensional (3D) mathematical description of the geological SAM structure, together with its surroundings, using GeoModeller program and based on petrological and geochronological data, tectonic measurements, gravity-magnetic data and current geological hypotheses; (2) investigating the relationship of SAM rocks in relation to each other and surrounded rock complexes (including the adjacent Sejny intrusion), (3) determining the locations of major tectonic zones and the dominant structural style; (4) examining the internal geometry and shape of the massif; (5) determining the thickness of different rock types forming massif; (6) determining the course of pegmatite, aplite and quartz veins as well as their age and the mechanism of emplacement; and (7) determining the source of the magma and the mechanisms of its evolution and geotectonic succession of AMCG rock suite (anorthosite-mangeryt-charnockit-granite (rapakiwi). Additional task of geophysical modelling will be to examine relationships that exist between the various geological rock formations and geophysical effects. In this context, it will explain the reasons for the observed negative gravity and magnetic anomalies related to SAM, which will have major implications for understanding the genesis and evolution of the massif.

The innovative nature of the research is to create the first, coherent spatial SAM geological model using all available data and their interpretation of geological and geophysical measurements, and then using them to study the genesis and evolution of the massif SAM. The model is created using mathematical tool - GeoModeller software, that allows for quick design and edit a variety of 3D geological models. Application of innovative U-Pb SHRIMP method for age determination on mineral separates zircon, monazite and titanite that contain in their composition radiogenic uranium and lead, from the Suwalki rocks (especially from vein hydrothermal rocks, pegmatites and applites): will restore the succession of geological processes.Achieved results of the planned project will have a significant impact on the development of knowledge concerning the genesis and evolution of igneous Suwalki rocks and related ore mineralization in Proterozoic Era, and more broadly allow us to recognize the nature and evolution of the lithosphere in ancient times in the history of the Earth and the Moon, where anorthosite complexes with iron-titanium mineralization occur.