The Grójec Fault has been known since the 1980s on the basis of seismic and borehole data. It is the best and perhaps the only example of a strike-slip fault being active during the Alpine inversion of the Polish Basin at the turn of the Cretaceous and Paleogene. Its unique and still unexplained feature is that the fault itself and its hypothetical extension towards the SW limits the large positive anomaly of the gravity field (Małopolska Gravity High) from the north-west. At the same time, a possible extension of the fault to the SW is the southern limit of a significant electrical conductivity anomaly of the lithosphere. These observations are intriguing since the sources of potential field anomalies in this part of Poland are usually located at considerable depth within the crystalline crust or even the upper Earth mantle. Therefore, a shallow reaching fault from the time of the Polish Basin inversion at the boundary between the Mesozoic and Cenozoic Era cannot be responsible for such a distinct variation of gravimetric and magnetotelluric anomalies.

This observation is the foundation of our working hypothesis, according to which the Grójec Fault, as it was known to date, is only the result of the youngest tectonic activity in the zone running NE-SW across the south-western margin of the Eastern European Craton. As part of our project, we intend to verify whether the Grójec Fault from the time of the Polish Basin inversion only reactivated a much older and deeper tectonic discontinuity. Magnetotelluric and geomagnetic deep sounding supported by analysis of gravimetric and magnetic anomalies and seismic data will be applied to study the lithospheric structure in the Grójec Fault Zone. Measurements will be used to calculate numerical models of conductivity distribution in the Earth’s subsurface using three-dimensional data inversion. Gravimetric and magnetic data will be the basis for the creation of a three-dimensional model for the top of Precambrian basement.

If the Grójec Fault was formed before the end of the Mesozoic and it is a crustal- or even lithospheric-scale structure, then the question of the possible cause of its origin is raised. Without excluding other possibilities that may arise during the project implementation, we plan to test two possible scenarios for the beginning of the Grójec Fault precursor. Firstly, some of the recent work on the structure of the Eastern European Craton suggests that the Grójec Fault is located on the extension of a collisional suture between Sarmatia and Fennoscandia, two terranes (microcontinents) forming parts of the Eastern European Craton. Sarmatia and Fennoscandia collided with each other in the Paleoproterozoic (about 1.8 billion years ago), assembling at that time, together with Volga-Uralia, the Eastern European Craton. The collisional suture of Sarmatia and Fennoscandia, if preserved until today, must be a broad structure reaching down to the base of the lithosphere. Secondly, the Grójec Fault lies directly north of the ending of the presently inactive Volyn-Orsza Continental Rift. This rift trending WNW-ESE, roughly parallel to the Grójec Fault, was active in the latest Proterozoic (600-550 million years ago). The Grójec Fault limits from the north-west the zone of generally continuous cover of sediments and volcanic rocks from the time of rifting. The rifting process could have created new or reactivate older structures that cut cross the entire Earth's crust.

Multiple reactivated "weakness zones" existing within old cratons, such as the Eastern European Craton and its possible extension to SW, is a phenomenon often described in the world literature. However, if our working hypothesis on the origin of the Grójec Fault was confirmed, it would be a unique example of an intracontinental fault zone. Complementing the database available with magnetotelluric measurements will allow geophysical imaging of this zone that extends at least from the base of crust to shallow Cenozoic sediments, with an exceptional worldwide record of activity from the Precambrian to Paleogene. With such an excellent case study available, it will be possible to expand the general knowledge on the mechanisms of intraplate deformation and genesis of intracratonic basins. The results of the project will be a validation of recently published numerical experiments suggesting that fossil collisional sutures conserved in the lower lithosphere of cratons can act as pseudo-plate boundaries being reactivated by far-field horizontal stress transferred from current plate boundaries. In the future, the Grójec Fault Zone can serve as a benchmark for other areas where certain structures are repeatedly reactivated during successive deformation pulses.