The aim of the project is to reconstruct the Pleistocene paleogeographic transformations recorded in the sequence of terrestrial deposits, mainly typical loess, commonly occurring along the Ukrainian section of the Dnieper River valley, the largest river in the borderland between Central and Eastern Europe. In our times this river flows across several vegetation-landscape zones (forest→forest-steppe→steppe). Loess deposits were formed in the cold periods (glacials) of Pleistocene as a result of mineral dust deposition. Dust was blown away by wind from the areas rich in such loose fine-grained material (e.g. from a wide valley of a large river) and deposited on the land surface as silt covers of different thickness and spatial extent; in warm periods (interglacials, interstadials) it was fixed by vegetation and was the parent rock for the successively developing soils. In Pleistocene the zone of long (980 km) and generally sub-meridional valley of the Dnieper River was characterized by spatial climate gradient because climate was distinctly different in the European areas periodically covered by the Scandinavian ice sheets and those out of their extent. Therefore, loess deposits formed along this valley, in the so-called periglacial climate zone, can be divided into a) proximal – deposited in the areas with glacial deposits, and b) distal – occurring in the ice-sheet foreland where the loess-soil sequences, well-preserved and often complete, are found, and the age of the oldest layers exceeds 1 million years.

Terrestrial geoarchives, including loess deposits, belong to the best (because continuous) recorders of paleoclimate and paleoenvironmental changes. The development of modern research methods allows us to find precise information about the factors influencing the Quaternary climatic conditions. However, a correct and reliable reconstruction requires the separation of the influence of local conditions (such as relief) and regional conditions (such as disturbances of atmospheric circulation due to the occurrence and oscillations of ice sheets) on the nature and frequency of changes recorded in loess-soil sequences, and the distinguishing them from the rhythms of global changes recorded in deep-sea deposits and ice. This is extremely important in achieving the main aim, i.e. correct stratigraphic correlation of climatic and environmental events reconstructed in a specific site with the records found in other, close and distant, sites, because only then it is possible to achieve correlation at the regional, over-regional, and global level. The area selected for research is an excellent testing ground for the studies of the relation between different factors affecting paleoclimatic and paleoenvironmental information recorded in loess. They will be determined in the selected valley and upland sites along the Dnieper River valley over a distance of nearly 700 km – from loess islands in the north to vast and thick loess covers in the south on the Black Sea coast.

Methods: The project realization will be based on the collection and compilation of geological, paleoecological, paleoclimatic and chronostratigraphic data. A good reconnaissance of the research area was already made. At first, we selected almost 19 profiles located along the Dnieper River valley and on its both sides, and 8 of them will be studied in detail. Some investigations will be carried out in the field (sedimentological analysis, paleopedological, and magnetic susceptibility analyses). Densely taken samples will be subjected to laboratory analyses (lithological, geochemical, micromorphological, paleobotanical, paleomagnetic, colorimetric and dating). Paleomagnetic studies will be carried out in two profiles near the Black Sea where we expect to find the Brunhes/Matuyama boundary as an important time datum. We also plan to determine the directions and strength of wind, based on the analysis of magnetic susceptibility carriers by measuring magnetic anisotropy. With such a definition of partial objectives of the study, the submitted project has both methodical and cognitive significance because the final result will be: a) recognition of the role of factors (from local to global) in the process of forming individual units of loess-soil sequences; b) reconstruction and environmental characteristics of the Pleistocene paleolandscape zones, which were crossed by the Dnieper River valley, and c) determining the scale of displacement of these zones due to climate change. In our times a climatic boundary between Atlantic and continental influences in atmospheric circulation runs along this valley. That is why the aim of the project is also to determine these relations in the Pleistocene.

Expected effects: Reconstruction and forecasting of climate changes is one of the greatest challenges of the present-day Earth and environmental sciences. The determination of climate variability and determinants allows us to understand the conditions of the development of civilization and society since the Paleolithic time. The project is a joint initiative and will be carried out by a team of well-known loess researchers from Poland and Ukrainian center in Kyiv. The former achievements of the team (a series of papers published in specialist scientific journals with a high impact factor) guarantee its success and widespread dissemination of the results obtained.