The global climate changes keep the public's attention like never before, as they begin to bring the real consequences for many local communities. Their real meaning for the Earth should be considered against the background of climatic and landscape changes that took place in the past in the last several hundred thousand years. Hence one can notice the continuous efforts of scientists to reconstruct these past processes. The indispensable research tools in this field are the dating methods that make possible to establish the time scale of investigated phenomena and the thermochronometric methods that allow to establish the thermal history of rocks related to the Earth' surface evolution. Among the many methods of dating, a particular position is taken by the luminescence dating, which determines the time of formation of the sediment layer. Luminescence dating makes uses defects of the crystal structure or external impurities present in the minerals. Such centres, called traps, are able to capture free electrons and keep them for a long time. The free electrons are generated in minerals as a result of a continuous ionization by radiation from radionuclides naturally occurring in the Earth's crust. In a dating laboratory, one assesses the number of the trapped electrons by measuring intensity of the light emitted as a result of their release from traps. Such an emission is called optically stimulated luminescence - OSL. Due to the fact that there is a close relationship between the number of electrons kept in traps and the duration of mineral exposition to ionizing radiation, after measuring OSL, one can indicate the moment when all traps were empty. In the case of sediment layer, this is the time corresponding to the last exposure of mineral grains to sunlight, e.g. during their transportation. Covering the sediment with another layer triggers the "luminescence clock". The degree of trap filling, and thus the intensity of mineral luminescence, depends strongly on the kind of trap and the temperature at which the capture of electrons takes place. The thermal conditions of mineral layers change when terrain surface evolves. For example, when the rocks are progressively exhumed toward Earth’s surface in response to erosion they cool down. Hence, reconstructing the time and rate of heating or cooling of geological formations, that is, the thermal history of rocks, one can know the nature of the changes of the Earth's surface that have occurred in the past. The thermal history of rocks is dealt with by thermochronometry. The filling of traps used in the OSL dating undergoes changes advantageous for use in thermochronometry at temperatures below 100 °C. This makes that the luminescence signal is suitable for testing temperature changes close to Earth's surface, up to a million years back. Estimating the precise cooling rates in this part of time scale is challenging for all other known and established thermochronometric methods, therefore, for several years, intensive investigation has been conducted to develop OSL thermochronometry. The main current problem of this field is the lack of its applicability to the reconstruction of processes occurring with slow temperature changes. Due to the limited number of traps in the mineral grain, after a certain time, all traps are filled, and thus saturation of the luminescence signal take place. This means that the ionizing radiation does not cause further increase in the OSL signal. The value of the ionizing radiation dose for which the effect arises in quartz and feldspars, the minerals hitherto used by OSL thermochronometry, impose limitation for the rate of temperature changes, at which the processes under test can take place, to rates from the range above 300 °C per million years. This limit may be lowered when the traps will be used which are fully occupied after absorption of dose significantly higher than those corresponding to the saturation of luminescence signal applied so far. Quartz is the most abundant mineral in the Earth's crust. A the same time, in relation to feldspars, which have found wider application in thermochronometry, it is a mineral with the structure more resistant to impurities. Hitherto, in the OSL thermochronometry, the luminescence signal of quartz has been taken into account which is the most commonly used in OSL dating. The earlier investigation of quartz shows that there are present many other kinds of traps in this mineral. Also those that are filled after absorbing really high radiation dose. The problem with applying them in the thermochronometry results mainly from the fact that there has been no systematic study of these traps so far. In particular, it applies to physical parameters that determine the dependence of trap filling on temperature and time. The aim of this project is to estimate these parameters by means of the newest techniques of optical stimulation and also to develop the methods that allow effective separation of the OSL signal particularly suitable for use in thermochronometry. Knowing the parameters defining the thermal properties of these traps will let either to answer to the question whether the participation of many different kinds of traps in the processes of their filling has an significant impact on the quality of thermometric results.