Optically stimulated luminescence (OSL) dating was applied to the Neolithic Vinča culture's type-site, Vinča Belo-Brdo, to establish best protocols for routine luminescence dating of similar Holocene sites, critical in understanding Neolithic to Chalcolithic cultural development. Equivalent dose (De) values were investigated for sediment samples using 63–90 μm grains on large and small aliquots, and single-grain laser luminescence (SGLL), and for pottery samples using large aliquots of 4–11 μm grains. The effects of changing water content and the different techniques available to establish radionuclide concentration were explored for their impacts on dose rate (Dr) estimates.

Ages for two pottery samples of 6.74 ± 0.37 ka and 7.04 ± 0.47 ka are in line with the existing AMS radiocarbon chronology for the site and are regarded as the best dates available. Sediment samples at Vinča show poor signal strength, and the uncertainty over past water content, in addition to the possibility of mixing and/or partial bleaching of the quartz, means that we do not recommend the use of sediment-derived ages at complex archaeological sites such as Vinča. OSL dating of fired pottery however, presents a powerful tool for generating independent chronologies at archaeological sites as well as providing additional constraints for Bayesian age models.