

Towards Luminescence Dating Of Turquoise Gemstone Using TL And OSL Methods

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Turquoise was among the first gem stones used in jewelry and possessing cultural value since 6000 BC (at least). In the past it was used as a stone of natural protection for the occupational groups who were exposed to especially high degree of risk such as pilots, air crews but now it is mainly use in jewelry and in modern gemstone therapy for those suffering from depression. The aim of this research is to identify and characterize this valuable stone scientifically by using both thermally stimulated luminescence (TL) and optically stimulated luminescence (OSL) techniques and investigate its potential use towards luminescence dating purposes.

Experimental investigation includes study of natural TL and OSL signal, as well as the sensitivity of both signals in successive dose - measurement cycles. Thermal activation curves were also studied {annealed sample 1273K (900C⁰)} which showed presence of at least three traps. The main dosimetric peaks have a peak temperature at the maximum at 339K (66C⁰) and 514 K (241C⁰). However, among these peaks, only the latter becomes of great interest for dating proposes. Both activation energy and frequency factor of this trap were determined and the mean trap life time was estimated to be in the order of 23.6ka.

The OSL resulting from the same trap was also studied by performing a series of thermal annealing experiment. A series of doses were delivered, ranging from 2.5Gy up to 40Gy for both signals and showed linearity in the dose response. Small sensitization was observed at 493K (220C⁰) and deactivation takes place in the range of temperature 773K (500C⁰). The results of the present work are very promising and clearly support the possibility of extrapolating to characterize provenance of turquoise according to geological location, authenticity testing and dating of the ancient turquoise artifacts and to reveal its efficient dosimetric application.