

ESR dating of quartz with regeneration method

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ESR (electron spin resonance) dating method is based on quantitative measurement of unpaired electrons in minerals which have been created by natural radiation through geological time scale. Quartz is one of the minerals which can be dated by ESR, and has many applications of dating because it is abundant on the Earth's surface.

Natural accumulation doses are evaluated by ESR measurement, and then are divided by natural dose rate estimated by other methods, in the ESR dating method. Gamma ray doses are given to samples prior to the ESR measurements in order to correct the efficiency of signal generation, which is possibly different for sample to sample. The ESR signal intensities are plotted against the gamma ray dose to fit regression lines or saturating exponential curves which are to be extrapolated to the zero ordinate to obtain the natural accumulated doses. The errors accompanied by this procedure of extrapolation are 10 to 20 %, one of the main causes of overall errors of ESR dating, while these errors are much smaller in TL (thermoluminescence) and OSL (optically stimulated luminescence) methods based on the similar physical principle because they adopt signal regeneration protocols. In the present study, we tried the signal regeneration protocol for ESR dating of quartz from tephra, where the ESR signals are once zeroed by heating followed by gamma ray irradiation.