

ESR dating of a quartz single crystal from the Menderes Massif in Turkey

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Abstract: Electron spin resonance (ESR) has been employed to date the most recent geological metamorphism by use of a large quartz single crystal extracted from the metamorphic region of Menderes Massif (MM) in Western Turkey. The ESR spectra showed two paramagnetic centers: Al and Ti centers. The former was used for dating, since the latter was already saturated by natural radiation. The age, estimated to be 1.8 +/- 0.5 Ma, does not agree with the previous age evaluated by isotopic dating techniques suggesting that the thermal or geothermal stressing history of the metamorphic region must have changed the apparent ESR age. A detailed annealing experiment at various temperatures was performed to investigate the influence of thermal annealing in the past and the resulting life time was calculated to be 8.4×10^4 a for the Al center, the lifetime for Ti being shorter than that for Al. The lifetime of Al is thus shorter than its ESR measured age. The discrepancy can be explained in terms of the present-day annual dose or U-238, Th-232, and K-40, concentrations being much smaller than the previous annual doses under severe environmental conditions, such as erosive, natural chemical etching and weathering processes.

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