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ESR Studies of a Quartz Single Crystal from the Menderes Massif-Turkey

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Abstract: In a recent work, quartz single crystal extracted from the pegmatitic vein in the Menderes Massif (Western Turkey) was investigated and the most recent geological events of the sample was dated using Al centers by ESR (electron spin resonance) techniques. The estimated age of 1.8 μ m 0.5 My agree with neither the previous age evaluated to be 12 My by using isotopic dating techniques nor the lifetimes of these centers in the sample. It was suggested that the thermal or geothermal stressing history of the metamorphic region must have changed the apparent ESR age several cycles in this period. The other possibility should also be considered that annealing and reirradiation processes repeated for many times over a long period might effect the paramagnetic characteristics, such as g (spectroscopic splitting factor) values, hyperfine structures of the centers as well as change the ESR ages. Hence the motivation should be investigated at least one cycle. In this study, the angular dependence of the ESR spectra of these centers has been surveyed to understand the influence of heating and reirradiation. Only g values of the Ti centers measured at 100 K could be investigated since their hyperfine structure was well-resolved, while the ESR spectra of Al centers were too complex for this investigation. The principal values and direction cosines of the g-tensor of the Ti centers were calculated to be nearly the same for natural, irradiated and irradiated-annealed-reirradiated samples. Ti centers destroyed by annealing were recreated by γ -reirradiation, at least for one step, without affecting the behaviour of the angular dependence of g.

Key Words: Electron Spin Resonance (ESR), dating, quartz single crystal

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