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Short-lived thermal peak from garnet geospeedometry in the inverted metamorphic gradient of the Nestos Thrust in the Rhodope Metamorphic Complex (RMC)

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Pressure, temperature and time (P-T-t) are among the most common variables that can be deduced from the study of metamorphic rocks. Although metamorphic recrystallization is mostly due to changes in pressure and temperature, the time of residence or the rate of change of P-T is commonly assessed by geochronological studies. In this work we attempt to link information from isotopic systems, petrological determination and diffusion kinetics in order to assess the activity of the major syn-metamorphic Nestos Thrust of the Rhodope Metamorphic Complex (RMC).
The RMC, in Northern-Greece and South Bulgaria, includes a synmetamorphic thrust complex that juxtaposes high-grade imbricate units on top of a medium-to-low grade unit. The metamorphic rocks exhibit an inverted metamorphic gradient with peak-metamorphic temperatures that increase upwards. Syn-kinematic migmatites occur in the immediate hanging wall of the thrust zone. U-Pb Sensitive High Resolution Ion Microprobe (SHRIMP) zircon geochronology on leucosomes from these migmatites yield Early Cretaceous crystallization ages (160-120 Ma), which are interpreted to date anatexis.
The duration of the high-temperature peak has been estimated with forward numerical modelling of garnet fractionation and diffusion. Garnets that display chemical zoning in their four major elements (Fe-Ca-Mg-Mn) have been investigated. Their chemical composition was compared to numerically generated compositions of garnet that grow and diffuse in a given P-T-t path. The duration of the peak-temperature conditions was found to be between 2 and 5 Ma. The short thermal peak and the spatial distribution of the high grade rocks along the major shear zone suggests that the heat source of metamorphism is most probably related to the viscous heating of this major shear zone.