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Mid-Miocene Magmatism and Extensional Dynamics within the Menderes Massif, Western Turkey

E. Catlos(1), I. Çemen(1), C. Baker(1), M. Kohn(2), E. Diniz(1), M. Göncüoglu(3), M. Hançer(4)

(1)Oklahoma State University, School of Geology 105 Noble Research Center, Stillwater, OK 74075 United States, (2) University of South Carolina, Department of Geological Sciences 701 Sumter St., Room EWS 617 University of South Carolina, Columbia, SC 29208 United States, (3) Orta Dogu Teknik Universitesi, Jeoloji Muh. Bolumu, Ankara, 06531 Turkey, (4) Pamukkale Universitesi, Muhendislik Fakultesi Jeoloji Muh. Bolumu, Denizli, 20070 Turkey

The central Menderes Massif metamorphic core complex in SW Turkey exposes amphibolite-facies rocks with ages of prograde metamorphism ranging from the Cambro-Ordovician to the Eocene-Oligocene. The region experienced a transition in the Cenozoic from compression and prograde metamorphism to large-scale extension and core complex formation. This type of tectonic and petrologic succession may be "normal" for orogens due to gravitational collapse of over-thickened crust, or, alternatively, extension may be driven by other forcing factors, such as back-arc spreading. The age of the initiation of extension is crucial petrologically and tectonically because it delineates among different mechanisms for the exposure of high-grade metamorphic rocks and aids in understanding how the massif relates to other tectonic elements within the Aegean region. Here we report Th-Pb ion microprobe monazite ages and X-ray element maps, cathodoluminescence images, and whole rock geochemical data from two synextensional granites (Salihli and Turgutlu) located approximately 30 km apart along the northern (Alasehir) detachment of the Menderes Massif, as well as from three pelitic assemblages collected in close proximity to the Salihli granite. Monazite ages can be affected by fluid-mediated dissolution-reprecipitation reactions along a retrograde path, but the mineral's ability to recrystallize during multiple geologic events provides information about complex metamorphism and can be used to complement zircon or 40Ar/39Ar ages. The granites have similar REE and HFSE patterns and share a volcanic-arc signature. Salihli samples contain allanite as the dominant REE host phase. One Salihli rock collected from the detachment surface itself

contains monazites with low radiogenic Pb* that range in age from 9.1+/-1.6 Ma to 21.7+/-4.5 Ma, with an average of 15.0+/-2.8 Ma. The youngest age is in a high-Th domain, and may represent re-crystallization of a preexisting grain. Turgutlu granites contain highly radiogenic monazites that are 11.5+/-0.8 Ma to 19.2+/-5.0 Ma, with an average of 15.0+/-1.7 Ma. X-ray element maps of some of the larger Turgutlu grains show high Th cores, low Th mid-rims, and high-Th outer rims. We speculate that both granites originated from the same source, possibly the melting of the surrounding metamorphic assemblages during extension. Whole rock compositional and trace element analyses of the metamorphic rocks collected near the Salihli granite along the Alasehir detachment show the samples are enriched in LREE and have similar trace element patterns. These metamorphic rocks contain monazite that range from Oligocene to Early Miocene, even within a single sample. The ages reported here are similar to dates thought to constrain extension elsewhere in the Aegean, and can be linked to other key tectonic elements, including, for example, the Southwest Anatolian Shear Zone.