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A relatively pristine C-like component in the eastern Anatolian asthenosphere

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Eastern Anatolia (Eastern Turkey) resides in the Alpine-Himalayan orogenic belt and hosts the Eastern Anatolian Volcanic Province (EAVP), one of the volumetrically most important volcanic provinces within the circum-Mediterranean region. Previous studies have revealed that the predominant portion of EAVP is composed of the products of the sub-continental lithospheric mantle (SCLM) metasomatized during subduction of the Neo-Tethyan slab. The wide distribution of the lithospheric signatures in EAVP lavas has led to the availability of a large number of geochemical information regarding the regional SCLM in eastern Anatolia. In contrast, the nature of the asthenospheric mantle of eastern Anatolia remains poorly constrained due to scarcity of the asthenosphere-derived melts and lack of detailed information on the source components it comprises. Hence, this study aims primarily to put constraints on the chemical nature of asthenosphere beneath eastern Anatolia by a detailed characterization of its end-members.

In this study, we provide new trace element and Sr-Nd-Hf-Pb isotope data from Quaternary Elazığ volcanism. This volcanism, entirely represented by mafic alkaline basaltic rocks, is one of the most recent members of EAVP, and its chemistry provides compelling evidence for a predominate asthenosphere origin. Modellings suggest that these mafic volcanics are largely free of crustal assimilation; their geochemical signatures, hence, closely reflect their source regions. Their trace element and Sr-Nd-Hf-Pb isotope systematics are consistent with derivation from an asthenospheric mantle source domain containing approximately 70% recycled oceanic lithologies with the characteristics of the C-like mantle component. However, minor contributions from depleted component (DM; ca. 20%) and an enriched component representing metasomatically modified SCLM (ca. 10%) are also needed to explain their total range of isotope data. With these findings, we propose that the C-like material is dispersed within the asthenosphere, and has mixed with the depleted mantle matrix beneath eastern Anatolia. The SCLM domains, on the other hand, occur as detached pods, following the lithospheric delamination in the region. Having triggered by the extensional dynamics during Quaternary, upwelling of the hot asthenosphere resulted in the melting of the C-DM and SCLM domains. Subsequently, the C-DM melts interacted with the SCLM-type melts, eventually generating the Elazığ volcanism.