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Crust-mantle interaction and petrogenesis of the Quaternary volcanism in the Eastern Turkey, Erzincan: Sr-Nd-Pb isotopic, geochemical and geocronological evidences

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Whole-rock geochemical and Sr, Nd and Pb isotope data are presented for a representative suite of the Quaternary Erzincan volcanics (QEV) from the Erzincan basin along the North Anatolian Fault Zone in order to resolve the origin of geochemical signature of the most recent volcanism in Eastern Turkey. Unspiked K-Ar and ^{40}Ar/^{39}Ar dating of lavas from the QEVs yield ages of 102 $\pm$ 2 to 1060.7 $\pm$ 87.9 ka. The QEVs range from high-K low silica trachy andesite to rhyolite in composition, with rhyolite volumetrically the most abundant. All rocks show high K-calc-alkaline affinity, a geochemical signature common to many post-collisional magmas. They display the following chemical signatures: (i) enrichment in large ion lithophile (LIL) elements (Rb, Ba, K, Th), light rare-earth (LRE) elements (La/Yb)$_{CN}$= 3-33), and depletion in high field strength (HFS) elements (Ta, Nb, Hf, Sm, Y, Yb), (ii) pronounced negative Nb and Ti anomalies, and (iii) small negative Eu anomalies in andesitic to dacitic and significant Eu anomalies in rhyolitic samples. These rocks have homogeneous and relatively low ^{87}Sr/^{86}Sr =0.70404-0.70587 and slightly depleted Nd isotopic compositions (ε_{Nd} from -0.9 to 2.8), with significantly varied Mg# ranging from 1.7 to 53. The old T$_{DM}$ model age (3.08 Ga) of the most evolved rhyolite suggests that high proportions of crustal components were incorporated in their petrogenesis. However, Pb isotopic compositions [(^{206}Pb/^{204}Pb) = 18.90-19.02, (^{207}Pb/^{204}Pb) = 15.64-15.70,

($^{208}Pb/^{204}Pb$) = 38.91-39.97] reveal a profound enriched source signature (EM II), which implies that some portion of metasomatized lithospheric mantle could have contributed to their genesis. Compositional and textural disequilibrium and the positive correlation of Sr and Nd isotopic ratios suggest that mixing of basic and acid magmas played an important role in magma genesis. A possible scenario for the genesis of these volcanic rocks is: basaltic magma formed as a result of partial melting of a subcontinental lithospheric mantle (SCLM) source responding to a possible upwelling of astenospheric mantle; underplating of these high-T basaltic magmas sparked melting of a juvenile lower continental crust producing rhyolitic melts; then magma mixing between basaltic and the rhyolitic magmas followed. Fractional crystallization (FC) coupled with contamination by upper continental crust could have played an important role in the evolution of mixed magma. Modelling based on Sr and Nd isotope data suggest that less than 10% of an isotopically depleted basic magma, which was chemically enriched in LILEs and LREEs due to metasomatism by fluids released from a subducting slab, was involved in the generation, but a juvenile lower continental crustal reservoir contributed about 90% of the source material for the QEVs.