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Eocene slab break-off revealed by the E-W distribution of the multi-sourced granitoids and tectonic denudation in the eastern Pontides, Turkey

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The Eocene multi-sourced granitoids throughout the central and eastern Pontides, NE Anatolia, Turkey, show a remarkable E-W alignment with a “within arc” rather than “back arc” character. They outcrop either as part of the composite Kackar batholith or as discrete intrusions in the early to middle Eocene volcano-sedimentary sequence deposited in fault-controlled basins. Their diverse mineralogy and geochemistry subdivides them into three groups: (**1**) I-type CALK metaluminous: the Ayder K-feldspar megacryst granitoid (S of Camlihemsin-Rize), the Uzuntarla porphyritic granodiorite (S of Arakli-Trabzon), the Zigana granitoid (S of Macka-Trabzon), Dolek and Saricicek granitoids (near Gumushane), and the Saraycik granitoid (near Bayburt); (2) A-type ALK metaluminous: the Cambasi quartz syenite and Bektasyayla quartz monzonite (SE of Ordu), the Kosedag syenite (around Susehri-Sivas), the Sisdagi and Kurucam granitoids (near Trabzon); (3) M-type medium-K CALK to THOL: the Halkalitas quartz diorite and low-K THOL Ardesen gabbro and Isina diabase, which are mainly exposed as shallow-seated small stocks and N-S, NE-SW, NW-SE and E-W trending veins (S of Ardesen-Rize). The K/Ar, Ar/Ar, U/Pb and titanite fission-track ages of about 50 to 40 Ma date the emplacement and cooling of these units, and are consistent with the stratigraphic relations. Textural and petrological data reflect a multi-sourced origin resulting from mingling and mixing of coeval mantle- and crustal-derived melts with metasomatized mantle and subduction signatures. This high

compositional diversity of the Eocene granitoids occurring quasi-simultaneously with the ca. 50 Ma fast tectonic denudation of the granitoids indicated by apatite fission-track age-versus-elevation data in the Dereli-Sebinkarahisar area, S of Giresun, reveals slab break-off, i.e. the buoyancy-driven detachment of the subducted denser oceanic lithosphere from the lighter continental lithosphere which follows it during continental collision between Eurasia and Tauride-Anatolide platform. The advection of hot asthenosphere to the base of the continental lithosphere induces partial melting of enriched metasomatic layers, which have been modified by the preceding subduction producing ALK and CALK magmas. The detachment and consequent rebounding of the continental lithosphere from the down-pulling oceanic lithosphere triggers fast tectonic denudation. The high compositional diversity of the resulting granitoids is thought to depend on the degree of melting and source material. ALK melts result from a small degree of melting of the enriched layers, whereas the CALK melts arise from a slightly higher degree of melting of more fertile or hydrated peridotite layers. The injection of these mantle-derived magmas leads to crustal melting, producing felsic magmas. The consequent mingling and mixing of these mafic and felsic melts generate bimodal hybrid granitoids with a wide compositional range, even in a short time span.