Petrological implications of temporal and spatial variations in magma chemistry of the Quaternary Tendurek shield volcano, Eastern Anatolian Collision Zone, Turkey

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The Quaternary Tendürek Volcano is one of the largest eruption centers of the Eastern Anatolia with a summit elevation of 3538 m and a footprint area of 650 km^2. It is a shield volcano consisting of lavas ranging in composition from tephrites through benmoreites/phonolites to trachytes. The young volcanism of the region is thought to be related to the continent-continent collision taken place after the closure of the Neo-Tethys Ocean. The Tendürek volcano is of special importance, because it is one of the rare places in Eastern Anatolia where calc-alkaline and potassic alkaline volcanism coexisted.

Lavas of the Tendürek volcano are classified on the SiO_2 versus K_2O diagram as medium K / high K and shoshonitic series. Medium to high potassic basalts, trachy-basalts, tephrites and basaltic-trachyandesites basically follow a partial melting trend on La vs. La/Yb diagram in contrast to the trachy-andesites, phonotephrites, tephriphonolites, phonolites, and trachytes of the shoshonitic series aligning along a fractional crystallization trend. The high-SiO_2 shoshonitic rocks (i.e. phonolites) uniformly contain lower concentrations of TiO_2 (0.52-1.17 %), MgO (0.46-1.05 %) and CaO (1.01-2.93 %) and high values of K_2O (3.95-5.16 %). The high-SiO_2 phonolitic lavas have a more pronounced enrichment in incompatible elements, such as Rb, Th, La and Nb, in comparison to those in the other shoshonitic rocks. The aforementioned differences in the chemical compositions of these two groups of shoshonitic rocks may reflect variations in the fractional crystallization process which involved clinopyroxene and plagioclase during the petrogenesis of the potassic rocks.

The global climate impact of civil aviation

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Aircraft emissions affect climate change through increasing carbon dioxide (CO_2) but also a host of other short-lived non-CO_2 effects that are complex, involve impacts that are both warming and cooling and are unique to this sector. Previous assessments of aviation climatic impacts have used a segmented approach whereby each effect was calculated separately and the effects summed. Integrated approaches using newly available Earth System models that allow simulation of more realistic interactions between effects are now possible and give different results. Here, we apply the NASA GISS Earth System Model to reassess the net radiative forcing on 20- and 100-year timescales due to year 2006 emissions from civil aviation including the effects on ozone, methane, sulfate, black carbon, water vapor and CO_2. A new hourly resolution aviation emissions inventory that was developed using the Federal Aviation Administration's Aviation Environmental Design Tool is applied. The model includes interactive tropospheric and stratospheric chemistry, full coupling between gas-phase chemistry and aerosols in the exhaust and background atmosphere. The sensitivity of the ozone climate impact to altitude of emission injection is examined for aircraft emissions and compared to other major anthropogenic surface sources of precursors. The climate impact of global desulfurization of jet fuel is examined. Global mean temperature response to aviation emissions is compared relative to the impacts of other major economic sectors.