Geophysical Research Abstracts
Vol. 14, EGU2012-6002, 2012
EGU General Assembly 2012

Multiple explosive rhyolite/trachyte eruptions of alkaline-peralkaline Nemrut and dacite/rhyolite eruptions of neighboring subduction zone-related Süphan volcano over 600 000 years: the East Anatolian tephra province

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The active Nemrut stratovolcano (2918 m asl) (Eastern Anatolia) is topped by a spectacular caldera and dominates the area west of huge Lake Van that covers its lower flanks. The stratovolcano has been active explosively for at least ca. 600 ka based on drilling evidence (ICDP Paleovan project). We have identified, correlated and compositionally characterized some 40 fallout sheets on land – none previously known – the largest ones probably with magma volumes exceeding 30 km3(DRE). The alkaline to peralkaline tephras are dominated by anorthoclase, Fe-rich clinopyroxene and fayalite with quartz and aenigmatite in some. Large-volume comenditic to pantelleritic rhyolite eruptions occurred in intervals of 20 000 – 40 000 years with smaller volume trachytic tephra deposits in between reflecting overall fairly constant magma transfer rates periodically fractionating to highly evolved rhyolite in larger magma reservoirs. Many of the ca. 10 widespread ignimbrite sheets, nearly all newly recognized, commonly followed on the heels of rhyolitic fallout sheets. They are more mafic than the underlying fallout deposits, magma mixing being common. Widespread spectacular agglutinates represent a late phase of the youngest large-volume fallout/ignimbrite eruption at ca. 30 ka. Active Süphan stratovolcano (4158 m asl), some 50 km NE of Nemrut and bordering Lake Van to the north, is dominated in contrast by subduction-related chemistry and mineralogy, smaller-volume eruptions and more advanced crystallization of magmas prior to eruption. Chief phenocrysts comprise complex disequilibrium assemblages of clinopyroxene, hypersthene, olivine, strongly zoned plagioclase, biotite and/or amphibole and common clots of fractionating phases. Many of the highly viscous and crystal-laden Süphan magmas were emplaced as domes and debris avalanches next to fallout sheets and ignimbrites.
The dominant NE direction of fan axes of partial isopach maps of ca. 15 major fallout deposits reflecting prevailing wind directions for more than half a million years suggest that well-dated tephra markers of alkaline/peralkaline Nemrut, and sofar less well-dated “calcalkaline” Süphan and Ararat volcanoes represent a major tephrostratigraphic framework that should provide for excellent tephra markers in neighboring countries (e.g. Iran, Armenia, Aserbeidschan) and the Caspian Sea.