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The volcanic, geodynamic and climatic evolution of alkaline Lake Van, eastern Anatolia (ICDP Paleovan Drilling project)

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Alkaline Lake Van and adjacent active stratovolcanoes Nemrut and Suphan represent a coupled system that evolved over ca. 570 000 years. We present a preliminary synthesis of chronological, chemical, mineralogical, volcanological and sedimentological data obtained on ca. 170 of a total of ca. 450-500 tephra layers drilled at Site 2 of the ICDP Paleovan drilling project (2010). We compare these with the chemistry, mineralogy and volcanology of the ca. 570 ka onshore record of Nemrut Volcano adjacent to, and underlying, western Lake Van.

Nemrut explosive activity extends from ca. 570 ka to historic in age onshore and from ca. 580 ka to Holocene in the core. Most individual tephra layers are slightly peralkaline trachytes, larger volumes of rhyolitic tephras having been erupted at intervals of 30-40 ka. Fallout deposits dominate while the larger rhyolite eruptions are generally associated with ignimbrites onshore, thick massive tephra deposits drilled being interpreted as syn-ignimbrite turbidites. We infer stages of caldera collapse to be associated with large-volume rhyolitic eruptions.

Eruptive rates at Nemrut volcano apparently increased (onshore and core evidence) at ca. 200 ka. Tephras from adjacent subalkalic Suphan volcano dominate the felsic tephras drilled prior to about 200 ka. Nemrut volcanic explosive activity appears to have been roughly periodic while that of Suphan was more episodic and seems to have strongly waned during the past 200 ka with external forcing (seismic, hydroclastic) having been characteristic forcing mechanisms, the Nemrut magma system having been open throughout its recorded lifetime.

Basaltic tephras are most common in the lower ca. 100 m of the core and appear to represent dominantly subaqueous eruptions. The dominantly high-Al composition suggests parent magma to subalkalic Suphan system. A huge subaqueous to subaerial basaltic eruption at ca. 80 ka is represented onshore by large Incekaya tephra cone and widespread fallout onshore and throughout western Lake Van. It is the most widespread and voluminous seismic marker bed and represents one of largest basaltic explosive eruption globally with a volume of >1 km^3 (DRE).

We estimate about 30 % of the cored tephra layers to be reworked by various mechanisms. Wind-transported tephras appear most common and mostly associated with dry climate intervals. They range from nearly pure to mixed tephras containing a large proportion of xenocrysts and nonvolcanic and organic particles. We define thick fallout deposits consisting of fine-grained basal tephra and variously rounded pumice lapilli at the top as pumice raft deposits reflecting prolonged abrasion in pumice rafts covering the lake surface. Most significant are poorly sorted reworked tephra deposits containg abundant organic debris (plants, shell fragments), many also containing gypsum crystals and are interpreted as recording extended periods of low lake levels. Core intervals with abundant reworked tephra layers appear to correlate with seismically defined low lake level periods.

The initial fundamental precise stratigraphic and temporal correlation of the upper part of cores from sites 1 and 2, as well as with the onshore tephra record was based on several fallout tephra layers defined by chemical composition, highly concordant ^{40}Ar/^{39}Ar ages and nature of the tephra deposit.

There is a tentative correlation of higher eruption frequency with warm climate periods both within the cores and on land suggesting magma generation/eruption control via lithosphere loading.

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