Recent activity and magmatic processes at Batu Tara

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Batu Tara is an ultrapotassic stratovolcanic island in the eastern Sunda arc that has experienced semi-continuous strombolian-vulcanian activity from mid-2006 to present. The cumulative extrusive volume of this eruption cycle is minor, consisting primarily of ash, isolated blocks, bombs, and small flows ejected down the eastern escarpment. Lavas are vesicular porphyritic with clinopyroxene (Cpx), plagioclase (Pl), and phlogopite phenocrysts in a groundmass of Pl, leucite, titanomagnetite, olivine, apatite, Cpx, and glass. Petrographically they are most similar to the "younger group" of biotite-leucite tephrites described previously [1-3] but lack leucite phenocrysts and contain abundant groundmass olivine. Cpx phenocrysts in the latest eruptives are similar to older sequences, but tend toward lower Al, Al^{IV}/Al, Fe^{3+}, Ti, and especially Cr, and lack the high Mg/Fe and Cr repetitive bands common in older sequences [2,3]. Such bands, plus strongly zoned olivines and occasional Cr-spinel inclusions, probably reflect repeated intrusions of primitive melts into a pre-existing evolved reservoir. Thus, magma replenishment likely played a central role in triggering past eruptions. Another key distinction of the recent eruptives is that their apatites contain much higher concentrations of Cl (0.7-1.1wt%), SO_3 (up to 0.9 wt%), and calculated OH. Additionally, copper iron sulfide inclusions in phlogopite indicate sulfide saturation occurred at least locally within the magmatic system. These observations suggest that more recent magmas contain a significantly higher content of pre-eruptive volatiles. Batu Tara has transitioned from a voluminous, effusive, edifice-building volcanic system driven by input of primitive magmas, to an explosive eruption style where magmas lack evidence of direct primitive magma input but are enriched in volatiles such as Cl, H_2O, and SO_3. Such transition could be due to maturation and evolution of a pre-existing magma reservoir or a shift in source region or source transfer mechanisms. In any case, this change holds implications for the interpretation of monitoring data, anticipation of future eruptions, and evaluation of volcano hazards from this island.

[1] Brouwer (1940) Geol Exp Less Sunda Isl, Amsterdam. [2] Stolz et al. (1988) *CMP* **98**, 374-389. [3] Van Bergen et al. (1992) *Lithos* **28**, 261-281.