THE LARGEST VOLCANIC ERUPTIONS ON EARTH

Summary

The most important indices of volcanic eruption size include: erupted pyroclastic material volume (tephra volume); magma volume — the volume of euptive products excluding their porosity (Dense Rock Equivalent, DRE); and the magnitude, M — defined as the common logarithm of erupted magma mass minus 7. The tephra volume is the basis of the Volcanic Explosivity Index (VEI) scale. The weakest eruptions (VEI=0) produce $<10^{-5}km^3$ of tephra, whereas the strongest (VEI=8) erupt $>10^3km^3$ of tephra. Eruption of Tambora in 1815 (tephra volume = $160km^3$, VEI=7, DRE=$50km^3$, M=7.3) was the strongest explosive eruption in historical times. The largest historical lava effusions occurred on Iceland, e.g. from the Laki fissure in 1783 (DRE=$15km^3$, M=6.5). These almost recent eruptions were only modest samples of nature's powers. Mankind has not yet witnessed the largest possible eruptive events, which devastate continent-sized terrains and result in global climatic changes. Supereruptions of La Garita caldera, Colorado, USA, at 28 Ma (DRE=4500 km^3, M=9.2) and Toba, Sumatra, at 74 ka (DRE=$2700km^3$, M=8.8) were 90 and 50 times, respectively, stronger than Tambora. Products of even more powerful eruptions were recently recognized in areas of so called Large Igneous Provinces (LIPs). Largest lava effusions (DRE=$9300km^3$, M=9.4) dated at 64.8 Ma were recognized at Deccan, and largest ignimbrites (deposits of giant explosive eruptions), dated at 132 Ma, were identified at the Parana-Etendeka province. Eruptions of that size approach the limit of largest eruptions possible on our planet, which is probably determined by the ability of formation of crustal magma reservoirs large enough.