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Grain size, areal thickness distribution and controls on sedimentation of the 1991 Mount Pinatubo tephra layer in the South China Sea

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In the original publication of this article, Figs. 1, 2, 4, 5, 6, 8, 9 had not been reproduced correctly due to technical problems. We apologise for this mistake.
The correct versions of these figures can be seen here.

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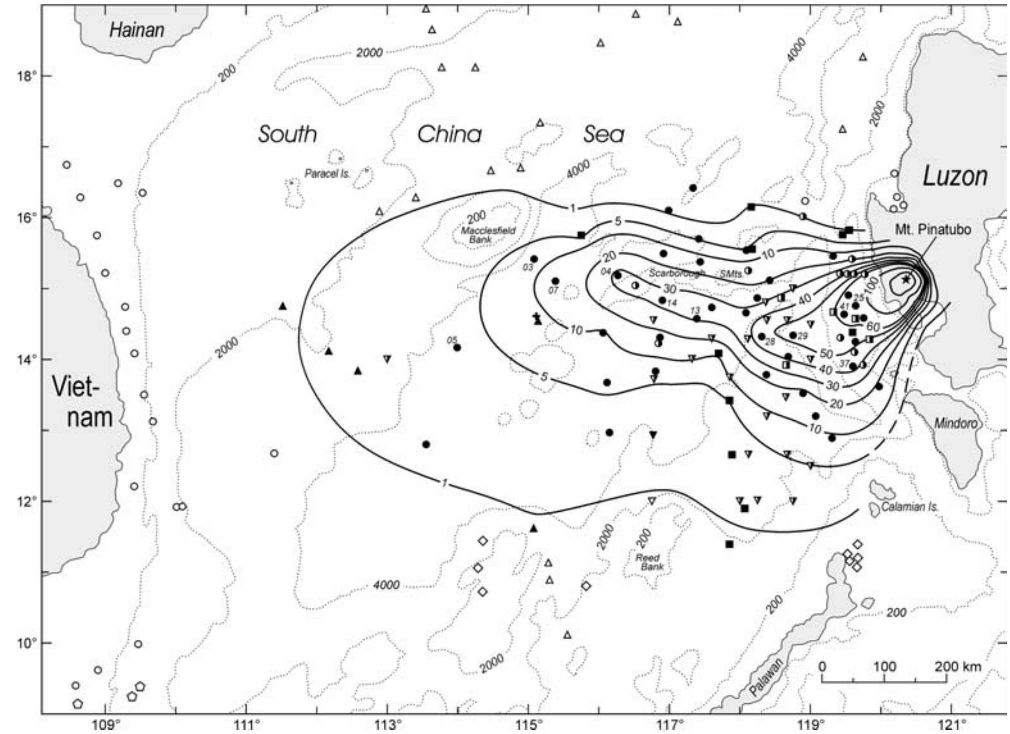


Fig. 1 Thickness contours (in mm) of the June 15, 1991 Mt. Pinatubo ash fall deposit in the South China Sea (*isobaths* in m) and on Luzon Island (*unlabeled isopach* is 200 mm). On-land thicknesses (*layer C*) were taken from Paladio-Melosantos et al. (1996) and E. Listanco (unpublished data 1991). Marine core sites are denoted as follows: *circles* R/V Sonne cruises SO-132 in 1998 and SO-140 in 1999 (this study); *triangles* SO-95 in 1994 (Wiesner and Wang 1996); *squares* SO-114 and R/V Ocean Researcher 1 cruise OR-455, both in 1996 (Kuhnt et al. 1996; Wiesner et al. 1997; Wang 1999); *pentagons* SO-115 in 1996/1997 (Stattegger et al. 1997); *diamonds* 1997 cruises of R/V Explorer (F. Siringan, personal communication 1998); *inversed triangles* 1998 cruises of R/V Xiangyanghong-14 (R. Chen, personal communication 1999); *cross* 1990–1992 sediment trap mooring station SCS-C (Wiesner et al. 1995). *Filled symbols* ash thickness measured; *half-filled symbols* ash observed, thickness not reliable due to core disturbance or postdepositional redistribution; *open symbols* no macroscopically visible ash. *Numerals* at core sites refer to those tephra sections that were analyzed by sieving/pipetting and correspond with the last two digits of the station labels given in Table 1 and Figs. 3, 4, 5, and 6

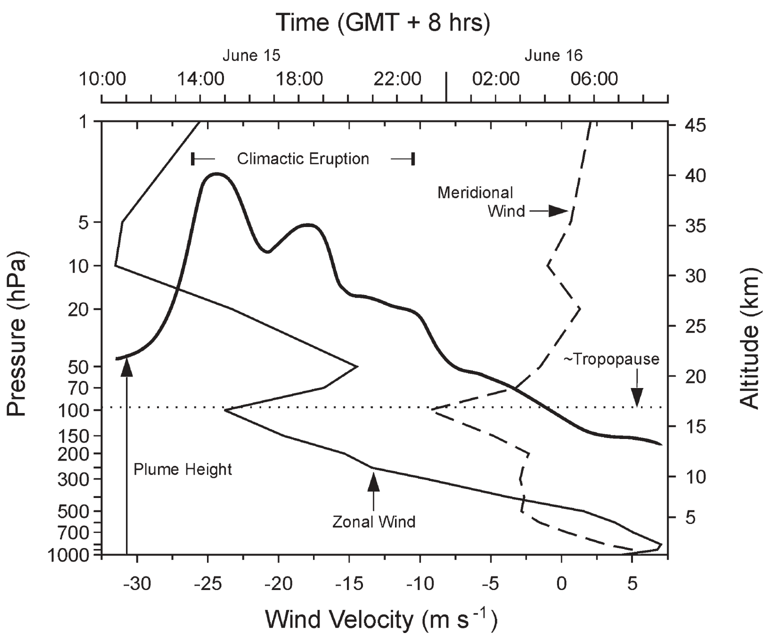


Fig. 2 Velocity-height section of mean zonal (*solid line*) and meridional (*dashed line*) winds on June 15, 1991, combined with the timing and plume top altitudes (*bold curved line*) of the June 15–16 Pinatubo eruptions. Wind velocities were obtained from ECMWF ERA-40 reanalysis data sets (for reference, see European Center for Medium-Range Weather Forecasts 2000) and averaged over the area 10.25°–18.75°N, 109.25°–120.25°E; positive (negative) values indicate westerly (easterly) flow for the zonal component and northerly (southerly) flow for the meridional component. Chronology of eruptive plume events was adapted from Holasek et al. (1996)

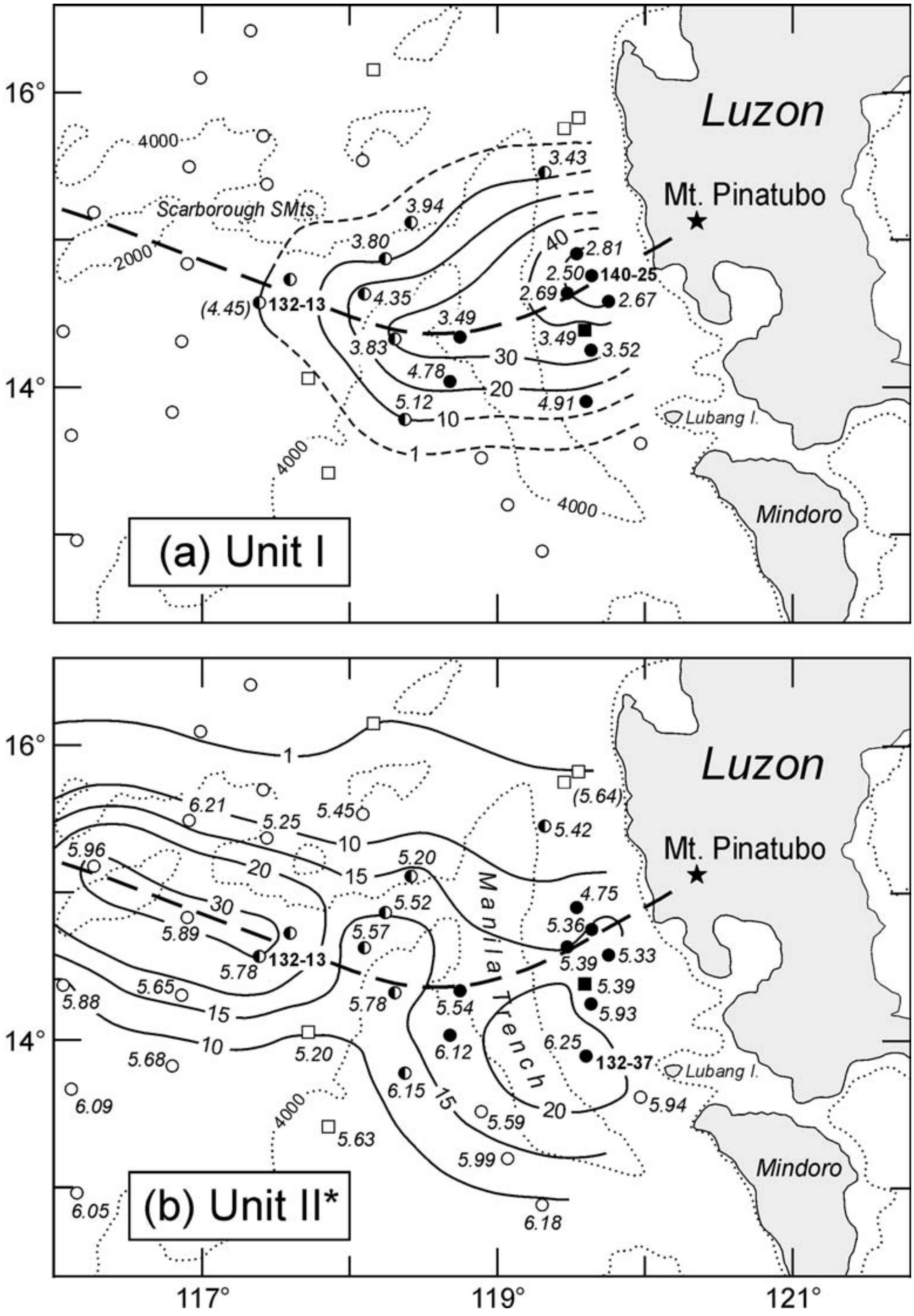


Fig. 4 Thickness contours (in mm) of **a** unit I (*unlabeled isopach* is 50 mm) and **b** unit II (*combined with the single ash layer to show the total distribution of fine ash). Core site symbols are as in Fig. 1 but *filled* where the boundary between unit I and II is sharp, *half-filled* where boundary is gradual, and *open* where no boundary is present. *Numbers* in italics at core sites are mean grain sizes (in ϕ-units) for the particle populations $<9\phi$. Values were obtained by the Laser method and converted to sieve/pipette particle means on the basis of the equation given in the section on Sampling and Methods (*bracketed values* denote sites where contamination of the ash section by particles from above and beneath was difficult to avoid during sampling). *Bold dashed line* represents the bulk ash lobe axis (see Fig. 1)

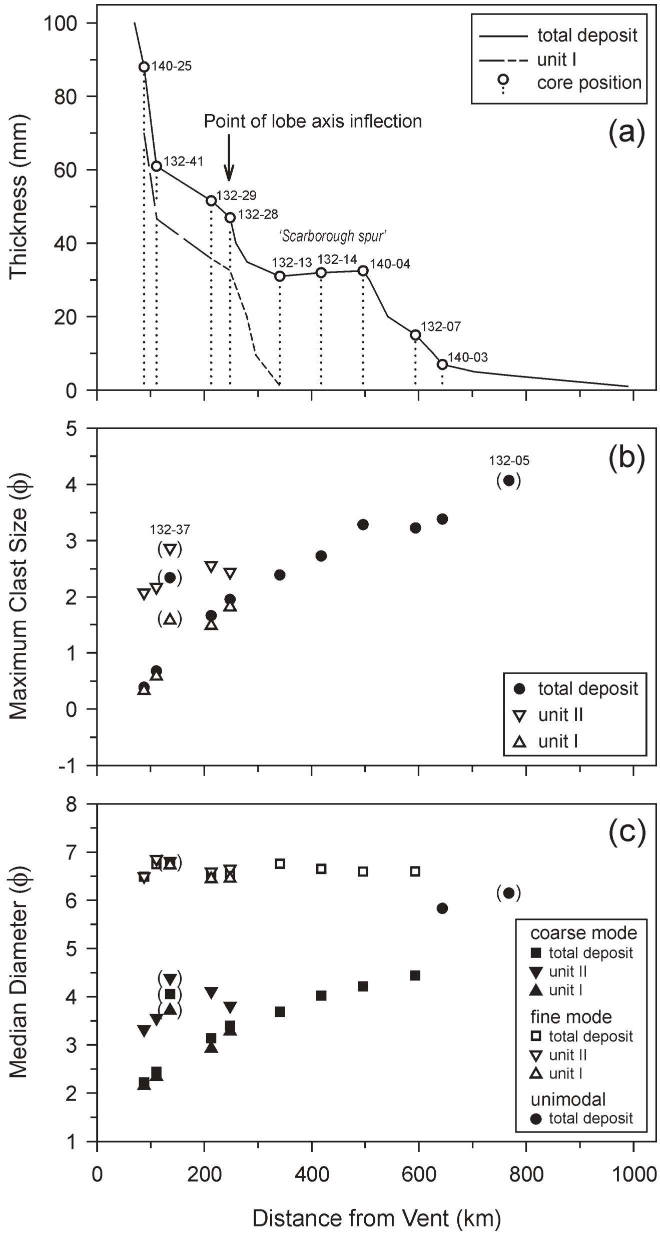
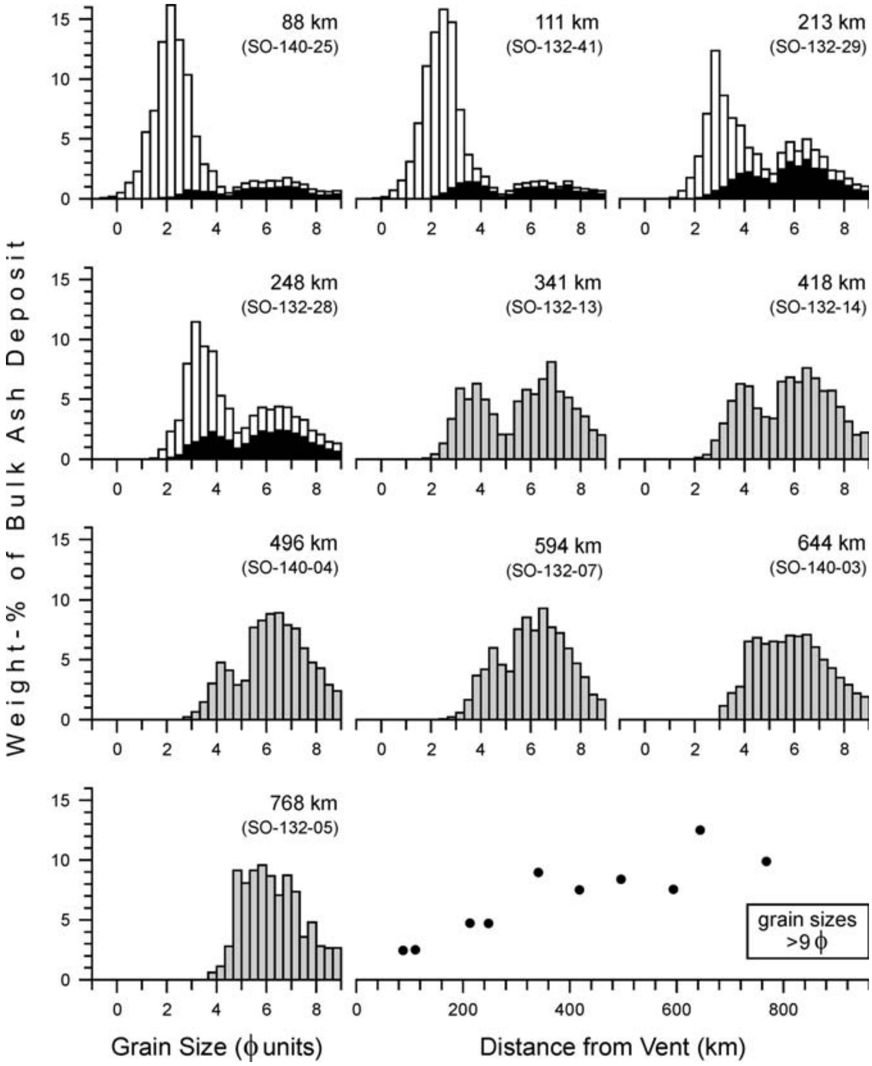


Fig. 5 Downwind variations in **a** thickness, **b** maximum clast size, and **c** median diameter of the submarine Mt. Pinatubo tephra layer and its stratigraphic units as a function of distance from source along the bulk ash dispersal axis. *Short-dashed thickness line* in **a** indicates diffuse contact between unit I and II. *Bracketed data* in **b** and **c** refer to core sites located south of the lobe axis (their source distance was orthogonally projected onto the center line; see Fig. 1 for core positions). Note that stations 132-37, -28, -29, -13, and -14 plot along a line which connects the thickness maximum of unit II with the one of the distal ash layer (cf. Figs. 1, 4)

Fig. 6 Bulk ash grain size distributions of the submarine Mt. Pinatubo tephra layer at increasing distance downwind along the main dispersal axis. Also shown is the percentage of ash in the >9ϕ size range as a function of distance from source. Size spectra of unit I (*open bars*) and unit II (*black bars*) are stacked and normalized to the bulk ash deposit on the basis of unit thickness and unit bulk density (averaging 1.3 and 1.1 g/cm^3, respectively); *grey bars* single ash layer. Note that at station SO-132-13 unit I was too thin (1 mm) to be analyzed separately by sieving/pipetting; also note that the distal station SO-132-05 is positioned south of the center line (cf. Figs. 1, 5, 6)



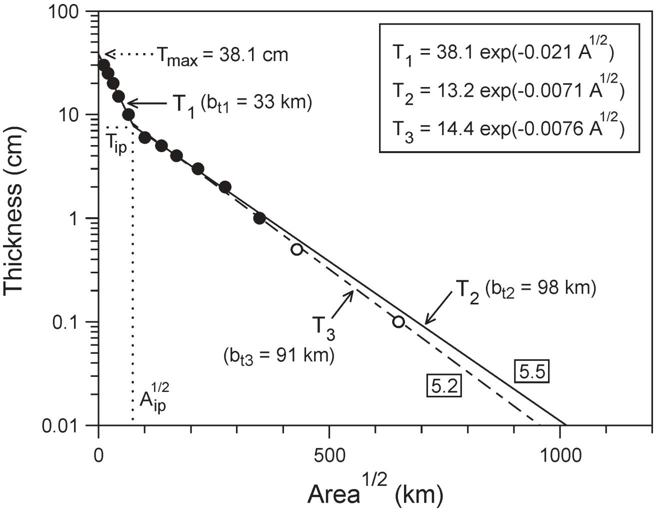


Fig. 8 Logarithm of thickness versus square root of isopach area for the June 15, 1991 Mt. Pinatubo ash-fall deposit along with two straight-line approximations for the isopach ranges 30–1 cm (T_1 and T_2) and 30–0.1 cm (T_1 and T_3) (see Fig. 1 for data source). *Open symbols* denote isopachs that could not be closed with confidence. *Inset* lists the regression equations for T_1, T_2, and T_3. *Numerals in boxes* are bulk volumes in km^3 calculated for the two straight-line segments T_1-T_2 and T_1-T_3 according to the method of Fierstein and Nathenson (1992). T_{max} is the extrapolated thickness at the vent; b_{t1}, b_{t2}, and b_{t3} are the thickness half-distances for the segments T_1, T_2, and T_3. *Dotted lines* mark the point of interception of the regression lines T_1 and T_2, with T_{ip}=7.7 cm and $A^{1/2}_{ip}$=76.3 km

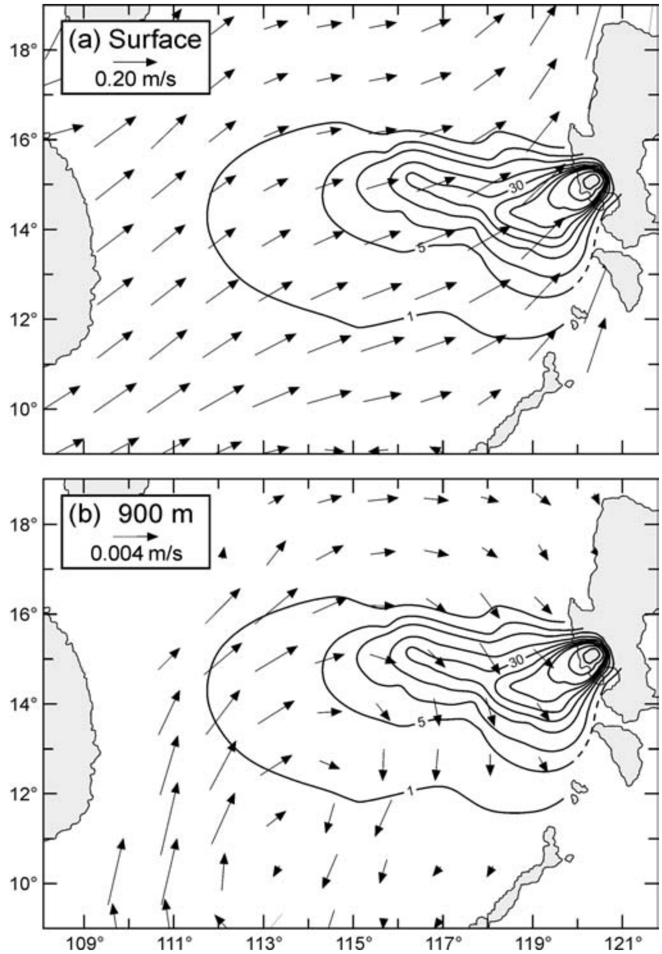


Fig. 9 Current velocity vectors in the South China Sea at **a** the surface (derived from June mean ship drift data; Levitus 1982) and **b** 900 m water depth (re-gridded from data modeled for the southwest-monsoon period by Chao et al. 1996). Scales of velocity vectors are 0.2 and 0.004 m/s. Pinatubo tephra thickness contour intervals (in mm) are as in Fig. 1