

is about 0.7 that carried by the silica particles of curve 1; hence the number of residuals must be much greater.

The gravity correction,³ which might affect the left hand or small particle limit of figure 3, could hardly be significant for particles as small as these, especially since, for $\beta = 0$, the smallest particles fall at the left hand ("easy to collect") limit of the original charge-weighted distribution (which in turn determines the small particle limit of figure 3). At this limit there is still some error due to nonparallel flow³; taking this, and the effects of diffusion³ into account, it seems probable that particles are present in the chamber down to molecular dimensions.

The most remarkable fact which emerges is that this residual atmosphere contains a large number of exceedingly small particles which are not present in the silica aerosol itself, nor in the salt aerosol. This can mean only that the larger silica or salt particles serve as aggregation centers for the minute residual particles.¹² This type of behavior is probably quite general for small particles in the presence of large ones.

It has not seemed profitable to attempt a detailed analysis of curves 2 and 3 of figure 2. Electron micrographs like those shown by Dautrebande and associates¹³ give the general impression that the salt particles are smaller than the silica particles. If this is so, it could account for the smaller x intercept of curves 2 and 3 in the "easy to collect" region (compared with curve 1). The greater extent of the salt curves in the direction of large x must then result from a different charge-radius relation than exists in the case of the silica particles—a relation in which the effective β might lie in the range 0 to 1, but would not approach 2.¹⁴ This is indeed reasonable in view of the different circumstances under which, and mechanisms by which, charge must be produced in the two cases. The result is a lower average charge per particle, which, because of the greater area (area being proportional to aerosol charge density) under the salt curves, necessitates a much greater number of the smaller salt particles, as is also required by the fact that the mass concentrations are comparable.

Curves 2 and 3 were made under conditions as nearly alike as possible with an 8 per cent solution of sodium chloride for curve 2 and a 2 per cent solution for curve 3. The measured mass concentration of the 2 per cent particles is 26 per cent of that of the 8 per cent particles, whereas their total charge (plus and minus) is

12. If the residual particles were produced mainly by the water aerosol rather than the stirring-up of dust, they naturally would not appear in the silica runs not made in the presence of water aerosol, nor in the salt runs. However, they did not appear in the few silica tests (not illustrated here) which were made in the presence of the water aerosol.

13. Dautrebande, L.; Kahler, H.; Lloyd, B. J., and Mitchell, E. R.: Studies on Aerosols: VII. Dust Aggregation with NaCl Aerosols; Differentiation Under the Electron Microscope of SiO₂ Dust Particles and NaCl Crystals, *Arch. internat. pharmacodyn.* **80**:413, 1949.

14. In agreement with this deduction is the fact that, after the aerosol had passed through a 20 l. settling chamber, the left hand ("easy to collect") portion of the salt curves was found to have decreased more than in the case of silica curves; i. e., the shift of the salt curve to the right was greater (see accompanying table). As we³ have shown, aggregation always tends to produce a shift to the right, whereas diffusion, which causes a shift opposing that due to gravity, tends to give a shift to the left for $\beta > 2$ and to the right for $\beta < 2$ (case 2). For such small particles and chamber, diffusion is predominant (see fig. 4). Thus for silica particles (β roughly 2) aggregation alone gives the shift to the right. For salt particles, diffusion gives the observed additional shift only if $\beta < 2$.