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COMPARATIVE DUST SIZING YIELDS UNEXPECTED RESULTS

"Things are seldom what they seem" is as true now as it was when William S. Gilbert wrote it many years ago. This applies particularly to the following article, which shows how the higher resolving power of the electron microscope altered a conclusion reached through observations made with less powerful optical instruments.

Use of the electron microscope in studying dust during a resurvey of the granite industry in Vermont resulted in the resolution of a question of particle size which had been puzzling investigators for some time.

The resurvey was undertaken by the Occupational Health Program, U. S. Department of Health, Education, and Welfare, and the Industrial Hygiene Division, Vermont Department of Health.

Comparative observations using the optical microscope and the electron microscope disclosed that tiny particles that the optical observers believed to be extremely fine granite dust were apparently particles of a fume-like substance intermixed with granite dust. The high resolution of the electron microscope was able to differentiate the granite particles from the fume-like substance, and although the exact composition of the fume is not known, it obviously is not a mineral dust but a general atmospheric pollutant.

The problem of the "extremely fine dust" was presented to investigators during routine dust-concentration evaluations. In these evaluations it was noted that there was an unusually high dark-field to light-field ratio in the particles counted.

As the dark-field method can render visible particles that are much smaller than those visible in the light field, investigators reasoned that new production instruments, wire saws, surface and contour grinders, diamond saws, and other methods of wet cutting by abrasive action, were generating the "fine" dust much finer than that generated by older types of percussive pneumatic tools. A large number of dark particles seen through the optical microscope were believed to be silicon carbide, known to be used in the granite sheds.

The primary method of measurement of dust from air samples in the Vermont granite sheds is to examine the dust under an oil immersion objective (× 97). Some samples were to be sized by the electron microscope as a check. The samples for sizing were collected on Millipore filters, which permit oil immersion viewing with a portion of the filter while another portion of the same filter can be prepared for electron microscopy.

The Porten graticule was used with oil immersion for optical sizing. Samples taken in the resurvey of the Vermont granite sheds revealed a large number of particles that appeared as small, black, poorly resolved specks, about the size of the smallest comparison circle in the graticule. This

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smallest circle has a calibrated diameter of 0.48μ.

When the results were tabulated, it was found that many of the samples had more than a majority of particles in the smallest size range, so that median size had to be estimated by extrapolation.

Investigators, using only the optical equipment, were seeing the fume-like substance and were sizing it as granite, since up to this time the samples had not been studied with the electron microscope. For 27 samples which were sized optically, the median particle size, as determined graphically, ranged from 0.2/μ to 1.5/μ. The average of the 27 median values was 0.5/μ.

Size determination done in earlier studies, using oil immersion and the filar micrometer, had indicated a median particle size of approximately 1.5/μ.

The samples that were prepared and photographed under the electron microscope show clearly (Fig. 1) the two distinct types of material that had appeared under the optical microscope to confuse the sizing. Part of the material is typical mineral dust, in this case assumed to be granite.

But the second material, having the appearance of a metal fume, is composed of many extremely small spherical particles agglomerated in irregular chains and groups of varying lengths.

The belief that this second material was a general atmospheric pollutant was confirmed when air samples were taken outside of the granite sheds and were examined by electron microscopy. The electron micrographs revealed the presence of this fume-like substance (Fig. 2) in the absence of granite dust. The substance is believed to be carbonaceous smoke particles from railroads and local heating systems.

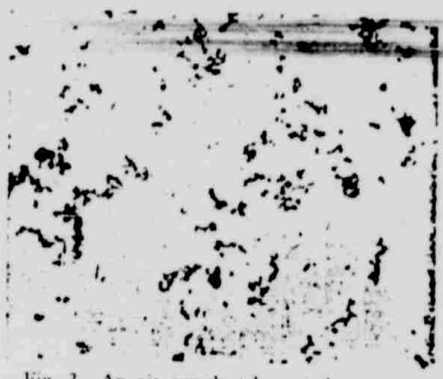


Fig. 2.—An air sample taken at the same time in Vermont at some distance from the granite sheds shows only the fume.

Electron micrographs of samples taken in the granite sheds at other times show no such fume to be present (Fig. 3).

When the electron micrographs are reexamined and the fume-like particles are ignored, particle size distributions show median particle diameters of 0.9/μ to 1.2/μ, with standard geometric deviations of 2.0 to 2.3. These compare favorably with size determinations genera
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Fig. 1.—Electron micrograph of an air sample taken in a Vermont granite shed shows a mixture of granite dust and an unidentified fume.



Fig. 3.—An air sample taken which shows only granite dust. In each micrograph the grid is 1.0μ.



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determinations usually found in industrial dusts.

The optical size determinations have been discarded, since they obviously are not representative of the dust with which the granite industry is concerned.

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THE AMERICAN UNION OF OCCUPATIONAL MEDICINE

Its Formation and Objectives

The American Union of Occupational Medicine was established in 1948 as a private organization, concerned exclusively with training, scientific research, and the advancement of occupational health in the Western Hemisphere. Its aim, according to its Articles of Formation, is study of the "hygiene, security and welfare of workers to bring about increased production and the highest spiritual and material standards of life for them." At the same time, the Union hopes to accomplish the spread of ideas and knowledge throughout the Americas by interchange of ideas, students, and materials.

Recognized by the International Commission on Occupational Medicine at Geneva, Switzerland, the American Union already has chapters in 16 nations of North, Central, and South America. In those countries that do not have organized chapters, the American Union works with occupational health physicians on an individual basis.

To promote its activities, the American Union supports Inter-American Congresses on Occupational Medicine, distributes information and publications, awards scholarships for study in the United States and in Europe, and supports a library of literature dealing with the many phases of occupational health. Headquarters of the American Union are at 981 Arenales Street, Buenos Aires, Argentina.

One of the first aims of the American Union was publication of a periodical dealing with occupational medicine. Since this is not financially possible, the official publication of the American Union is *Medicina del Deporte y del Trabajo*, or "Medicine of Work and Sports," official journal of the Argentine Society of Occupational Medicine, founded in 1934. "Medicine of Work and Sports" contains sections in Spanish, Portuguese, and English in order to reach the broadest possible audience.

The American Union also has organized a campaign to publicize both occupational medicine and the need for industrial hygiene. During this continuing campaign the American Union sponsored poster and pamphlet contests, established a number of prizes to stimulate investigation and research projects, and awarded student scholarships in occupational medicine.

Many of the important publications in the field of occupational medicine and industrial hygiene have been translated into Spanish under the auspices of the American Union so that physicians in South and Central American countries can read the work of their colleagues.

Since its organization the American Union has sponsored three Inter-American Congresses, in Buenos Aires in 1949, in Rio de Janeiro, Brazil in 1952, and in Caracas, Venezuela, in 1955. Specialists from all American nations and from Europe have attended their Congresses. In addition to the Congresses, the American Union has

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