1,250° C. an intensive cristobalite pattern appeared. As had been well known for many years, cristobalite is considerably more fibrogenic than quartz. These findings appeared to account for the mild changes found in workers exposed only to the crude dust, as compared with the "malignant silicosis" shown by the workers exposed to the calcined material.

In 1952 Smart and Anderson[97] published their first report of a number of years of observation of nearly 300 diatomite workers from five plants in California, Nevada, and Oregon. They concluded that inhalation of crude diatomite dust caused only a benign linear fibrosis with no symptoms or disability. However, they found extensive, and often rapidly progressive, fibrosis following excessive exposure to calcined and flux-calcined diatomite. Occasional cases showed massive fibrotic lesions, bullous emphysema, pleurisy, cor pulmonale, and spontaneous pneumothorax. Tuberculosis was uncommon and could not be identified in any of the massive fibrotic cases. In occasional cases where tuberculosis was found, it ran a benign course until cavities developed, following which the course was downhill and therapy ineffective. Fresh-water diatomite was found less toxic than the salt-water deposits.

It should be noted that diatomite deposits are skeletal remains of microscopic aquatic single-celled plants. The shells of these plants are pure opaline silica. When the plant dies, the organic material of the cell decomposes and leaves the skeletal remains as high-grade amorphous silica. These deposits may reach a depth of several hundred feet and date back millions of years. In this country commercially important deposits are found mainly in California, Nevada, Oregon and Washington. The material is removed by the open quarry method, with heavy-duty shovels, and transported to the mills. Its industrial uses are extensive, being a part of over 200 processes, including industrial filters, insulation materials, abrasives and polishes, building materials, insecticides, and explosives.

It has long been recognized that more factual information was needed concerning this disease before safe limits of dustiness could be established. The United States Public Health Service, therefore, was asked to make a survey of the diatomite industry on the West Coast two years ago. The report has only recently been released.[98] Five plants participated in the study.

Environmental studies were made in each of the five plants. Both salt-water and fresh-water diatomite in the crude state showed approximately 86 per cent total silica by weight. The quartz content in both crude and milled diatomite averaged 2 per cent. Cristobalite, however, was not found in the crude diatomite, but was high in the calcined and flux-calcined material. It averaged 32 per cent in the flux-calcined air-borne baghouse product. For the straight calcined product the cristobalite was slightly less, averaging 22 per cent in the baghouse product

[97] R. H. Smart and W. M. Anderson, Pneumoconiosis due to diatomaceous earth, *Ind. Med. and Surg.*, **21**, 509–518 (1952).

[98] W. C. Cooper, L. J. Cralley, *et al.*, Pneumoconiosis in the diatomite industry, *U. S. Pub. Health Bull.* (in preparation).

and 17 per cent in the main product. A considerable disparity is found in the per cent of cristobalite in the parent material, settled dust, and air-borne dust, yet the total cristobalite content averaged above 20 per cent.

The particle size distribution ranged between 0.5 and 2.2 μ and was remarkably uniform for all types of diatomite processing. Electron microscopy showed no evidence of any predominance of low-range submicron air-borne particles. The average median dust concentrations of all operations ranged from 1 to 66 million particles per cubic foot of air, with one third of the counts being below 5 million particles, one third from 6 to 11 million particles, and one third over 11 million particles. Weighted dust exposure data were not given because it is realized that dust control at the time of the survey was far better than in the past. This is well illustrated when counts made in 1953 are compared with those made in 1954, the latter averaging less than half of the former. Modernized handling methods are replacing hand loading, which has been the dustiest of all of the operations, particularly of the straight calcined and flux-calcined products. Paper bags have replaced burlap bags, and constant attention now is being given to good housekeeping. Dust now is being trapped at the source of its generation in so far as is possible. A respirator program is in force for protection during peak loads of dustiness.

In the medical studies, 869 workers from five plants were x-rayed and 786 had complete medical examinations and laboratory studies. Tuberculin, histoplasmin, and coccidioidin skin tests were done routinely. Lung function studies also were made.

Because pathological studies had shown the importance of considering the linear pattern on the chest films with this disease and because the panel of experts agreed that it was impossible to differentiate the linear from the finely nodular in many cases, a new classification was devised. The linear and nodular changes are grouped together as LN1, 2, and 3 and the classification is set up as follows:

0 — Normal.

LN1 — Questionable linear-nodular changes.

LN2 — Definitively abnormal linear changes or nodular changes, or both, involving an area less than the equivalent of two quadrants of the lung field.

LN3 — Linear changes, nodular changes, or both, involving more than one half of the total lung area, or extending to or nearly to the periphery of both lung fields bilaterally.

C1 — Confluent shadows of uncertain or ambiguous significance, superimposed on any of the foregoing.

C2 — Massive confluent opacities definitely present, extending over less than the equivalent of three anterior rib spaces on either side.

C3 — Massive confluent opacities definitely present, extending over the equivalent of three or more anterior rib spaces on either side.

C4 — Massive confluent opacities, associated with gross distortion of the pulmonary anatomy.

Using this classification, the panel of expert chest film readers agreed on the following findings: