RADIOGRAPHICAL APPEARANCE OF TALCOSIS AND COMPOSITION OF TALC

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The workers exposed to talc dust are increasing in number in textile, paper-making, glass-processing, ceramics, cosmetics, rubber and pharmaceutical industries, as well as paint, milling and carving of talc and so on. We investigated the concentration of the dust in the workshops in a mine and mill, and made a mineralogical examination. The chest X-ray films of the workers exposed to talc dust have been observed. The data are summerized and reported as follows.

INDUSTRIAL HYGIENE

This talc mine is a company of the mine and mill with an exploiting history of over 60 years. In the 50s and 60s, the dust concentration in the workplace of the mine ranged 68-582 mg/m^3 and the dust concentration in the mill ranged 208-5561 mg/m^3, and in talc carving factory, the dust concentration was several hundred mg/m^3.

The dust concentration in the workshop was reduced in the 70s, but it still ranged 50-395 mg/m^3. Over fifty percent of the particles were less than 5 μ in diameter; free silica dust ranged 0.75-2.87%.

MINERALOGICAL EXAMINATION OF THE TALC

The talc is pure, mineralogically, the ore is pure talc, the impurities are a little serpentine ($H_4Mg_3SiO_2O_9$) and phosphorite, little quartz, without tremolite $Ca_2Mg_5(Si_4O_{11})_2(OH)_2$ or other fibrous silicates (Figures 1-3).

In the talc mine, 80 cases of talcosis have been diagnosed under the medical supervision of Institute for Occupational Diseases since 1958 (male 70 cases, female 10 cases), exposure-onset duration ranging 5-22 years with an average duration of 13.6 years, grinder 57, excavator 19, worker for mineral separation 4. In talc-carving factory, 17 cases of talcosis were diagnosed, all of them are male, exposure-onset duration ranging 13-35 years with an average duration of 25.2 years. Of 97 cases of talcosis, 24 cases were complicated with tuberculosis (about 25%). In 73 cases of stage I talcosis, 12 cases (16.4%) complicated with tuberculosis, of 19 cases of the stage II talcosis, 9 cases (47.3%) were complicated ones. In 5 cases of stage III talcosis, complicated ones were 3 (60%). (Table I).

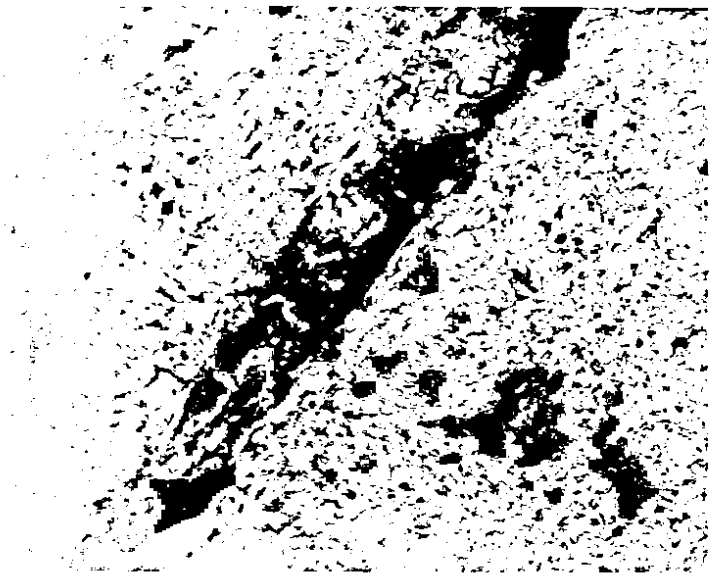

Figure 1. A fine streak of serpentine in talc in polarizing microscopy.

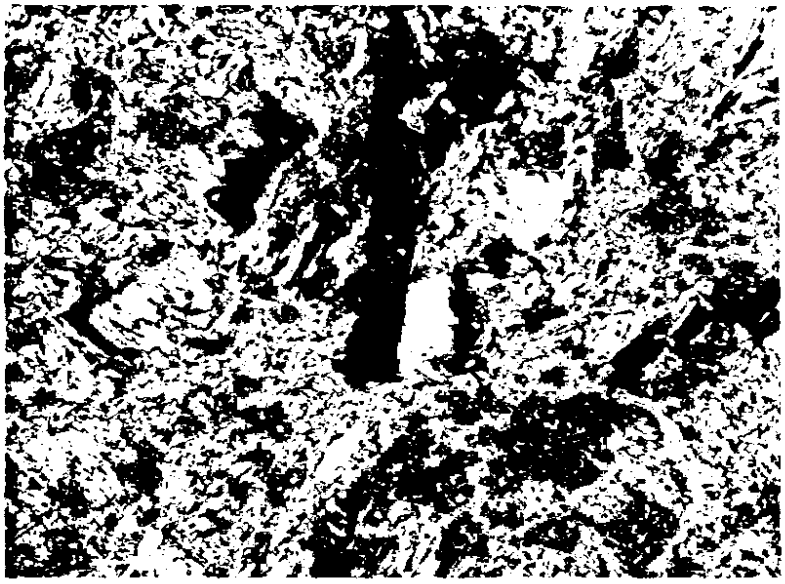

Figure 2. A bright silica particle in talc in polarizing microscopy.

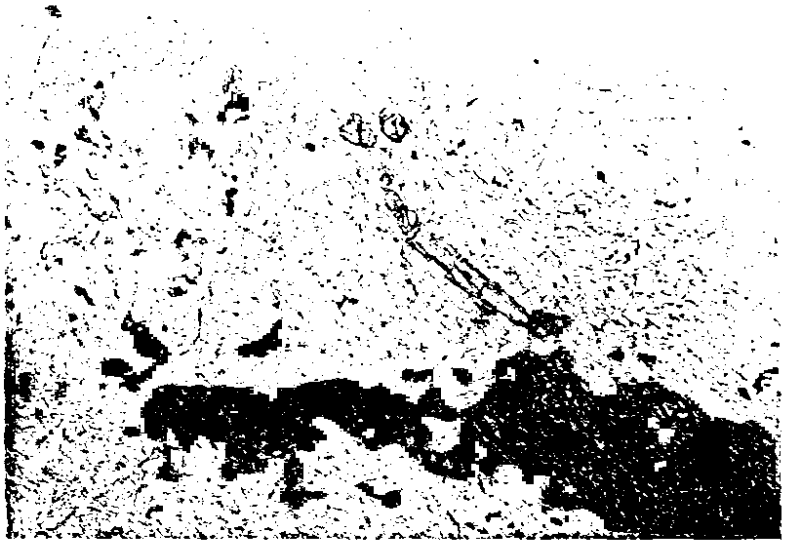

Figure 3. A few phosphorite particles in talc in polarizing microscopy.

X-RAY APPEARANCE

Unlike the radiographic appearance of silicosis, the enlarged hilar lymphnodes usually could not be found. The main characteristic findings of the talcosis were irregular small opacities; these abnormal findings must distribute beyond 2 zones for diagnosis. In some patients, the rounded small opacities were mainly observed. In most of them, the rounded opacities were 2-3 mm in diameter; occasionally, the rounded opacities were about 1 mm in diameter (Table II).

Nodular (Type) (15 cases): Of the 15 cases, 14 were grinders, exposure-onset duration was shorter than 10 years in 3 cases; 11-15 years in 11 cases; 16-20 years in 1 case. There were 3 cases of patients with 2nd stage talcosis, 2 cases with 3rd stage talcosis.

Reticulate-nodular Type: Of 56 cases, 40 were grinders, 16 excavators. The exposure-onset duration shorter than 10 years in 8 cases, 11-15 years in 22 cases, 16-20 years in 22 cases, more than 21 years in 4 cases. There was only one patient with 2nd stage talcosis.

Of 97 cases of talcosis, 5 cases with large shadow in the lung field, 3 of the cases were complicated with tuberculosis (Figures 4-8).

Pleural thickening, especially 'talc plaque' were not found in all of the patients. The relationship between the exposure-onset duration and the types of talcosis in 71 cases was noted (Table III).

COMMENTS

The relationship between silicates such as talc and pulmonary diseases was noticed at the end of 19th century, but the pulmonary damage and its X-ray changes in talc mine and talc processing workers had not been proved until the 30s of this century.[1,2] Serial survey reports began to appear in China since 1958. It has long been noticed that some impurities in talc (tremolite etc.) can cause pulmonary fibrosis, although this has not been confirmed yet.[3-10] In recent twenty years, the possibility of carcinogenesis by talc and impurities in talc was also a focus of much attention.[11-13]

Some authors held that the main causation factors in talcosis is the fibrous tremolite $Ca_2Mg_5(Si_4O_{11})_2(OH)_2$. Talc has cytotoxic effect, while tremolite has fibrogenic, besides the cytotoxic effects. They also held that the detrimental effect was related to the length of these fibers. The longer the fibers, the larger the effect.

Table I

97 Cases of Talcosis (X-ray Classification)

	I Grade		II Grade		III Grade	
	Simple	Complicated	Simple	Complicated	Simple	Complicated
No. Cases	61	12	10	9	2	3

Table II

X-ray Appearance of 97 Cases of Talcosis

	Hilus			Marking		Emphysema		Ret. and Nod.	Nod.	Pin Poi.	Larg Shad.
	Disturb. of Constr.	Dens.	Enl.	Incr.	Def.	Loc.	Dif.				
No.	80	57	23	89	75	10	6	75	14	6	6

Notes: Ret.Reticulat, Nod.Nodular, Nod.Nodular, Poi.Point, Larg.Large, Shad. Shadow, Dist.Disturbance, Constr.Constructure, Dens.Density, Enl.Enlargement, Incr.Increasing, Def.Deformity, Loc.Localized, Dif.Diffuse,

Figure 4. A male, 54 years of age, talc-cutter exposure-onset duration—23 years, 2nd stage talcosis with tuberculosis (nodular type).

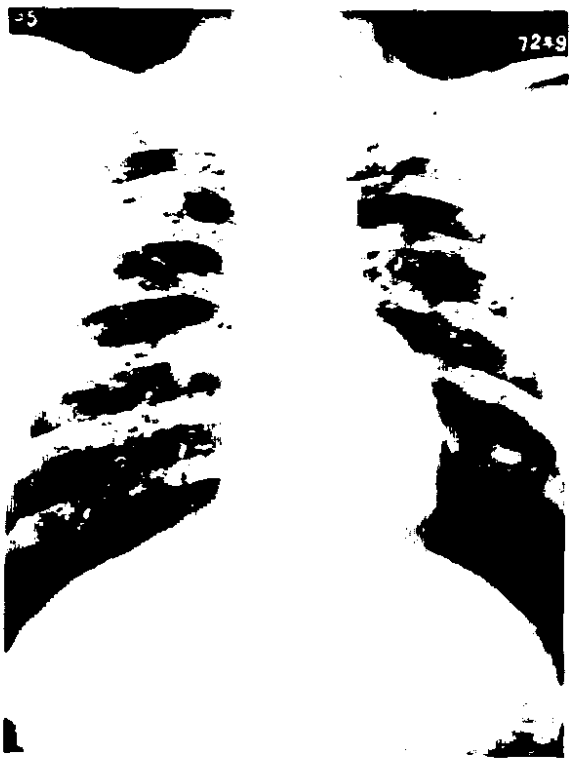

Figure 6. A male, 34 years of age, talc-cutter exposure-onset duration, 3rd stage talcosis.

Figure 5. A male, 29 years of age, talc grinder, exposure-onset duration—9 years, 2nd stage talcosis (reticulate—nodular type).

Figure 7. A male, 27 years of age, talc grinder, exposure-onset duration—6 years, 3rd stage talcosis.

Figure 8. A female, 29 years of age, talc powder packager, exposure-onset duration—5 years, 3rd stage talcosis with tuberculosis.

Table III

Relationship between the Exposure-onset Duration and the Types of Talcosis

		Nodular type					Reticulate-Nodular Type				
Exposure-Onset Duration(yrs)		-5	6-10	11-15	16-20	21-	-5	6-10	11-15	16-20	21
Grinder	I		2	7*			1	7	16	15	1
	II		1	2							
	III			1	1						
Miner	I			1'					6	6	3
	II									1	
	III										

*Including 3 cases of pinpoint type. 'One case of pinpoint type.

A dichotomy has been identified in the classification of 'talc': asbestiform 'talc', including anthophyllite, tremolite and chrysotile, and non-asbestiform talc. Early studies did not recognize this dichotomy and their different effects.

The pathological changes of talcosis are diffuse pulmonary fibrosis and collagenic nodules. There were reports that 'asbestosis-like body' was found in the pulmonary tissue and localized pleural thickening, granuloma was found at autopsy or biopsy and its small opacities in the chest film disappeared after corticosterone treatment.

As regards to the various descriptions of the X-ray appearance of the talcosis, that is apparently related to the purity of the 'talc'. In workers exposed to asbestiform 'talc', their X-ray appearances look like those of asbestosis, especially the talc plaques can be seen and the films of the workers exposed to non-asbestiform talc, look like those of silicosis.

The workers in this series exposed to pure talc in which we can not find any fibrous mineral (without tremolite, anthophyllite, amosite or chrysotile), the reticulate and nodular opacities in early stage talcosis and the large shadows in the advanced talcosis can be observed. These X-ray appearances look like that of silicosis.

REFERENCES

1. Dreessen, W.C.: Effect of Certain Silicate Dusts on the Lungs. *J. Ind. Hyg.* 15:66-78 (1933).
2. Dressen, W.C. et al.: The Effects of Exposure to Dust into Georgia Talc Mills and Mines, *Public Health Reports*, 50:131-143 (1935).
3. Seegal, W. et al.: The Dust Hazard in Tremolite Talc Mining, Including Roentgenological Findings in Talc Workers. *Amer. J. Roentgenol. Radium Therapy*, 49:11-29 (1943).
4. Greenberg, L.: The Dust Hazard in Tremolite Talc mining, Yale J. *Biol. Med.* 19:481-501 (1947).
5. Weiss, B. et al: Commercial Talc and Talcosis. *Arch. Environ. Health.* 14:304-308 (1967).
6. Kleinfeld, M. et al: Mortality Among Talc Miners and Millers in New York State. *Arch. Environ. Health.* 14:663-667 (1967).
7. Gamble, J. et al: An Epidemiological Industrial Hygiene Study of Talc Workers. *Ann. Occup. Hyg.* 26:841-859 (1982).
8. Berller, A. et al.: Talc Dust Pneumoconiosis. *Acta. Path. Microbiol. Scan. Sec. A.* 89:17-21 (1981).
9. Bowen, J.H. et al: Infantile Pulmonary Hypertension Associated with Foreign Body Vasculitis. *Am. J. Clin. Pathol.* 75:609-614 (1981).
10. Kleinfeld, M. et at.: Talc Pneumoconiosis, A Report of Six Patients with Postmortem Findings, *Arch. Environ. Health.* 7:101-115 (1963).
11. Merliss, R.R.: Talc-Treated Rice and Japanese Stomach Cancer, *Science.* 173:1141-1142 (1971).
12. Blejer, H.P. et al.: Talc Possible Occupational and Environmental Carcinogen. *J. Occup. Med.* 15:92-97 (1973).
13. Matsudo, H. et al.: Japanese Gastric Cancer, Potentially Carcinogenic Silicates (talc) from Rice. *Arch. Pathol.* 97:366-368 (1974).

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