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ATTACHMENT TO TABLE I

Memorandum to: Dr. George Thompson
Food and Drug Administration

From: S. Z. Lewin
Chemistry Department, New York University

Re: Determination of Asbestos Contents of Commercial Talcum Powders.

This will serve to summarize the main points of our discussion on this date of July 10, 1973 with respect to the factors involved in the detection and estimation of asbestos in talc, and the status of the tabulation of results of the analyses of commercially available consumer products containing talcum powder.

My research group has been engaged in studies of talc and its accessory minerals continuously since July 1971, and we are continuing to work in this field. We have undertaken to investigate the following problems:

A. Tabulation of the x-ray diffraction data for talc and all solid phases (whether naturally occurring, or added in the course of processing) encountered with talc in mineral, industrial, cosmetic and pharmaceutical products.

B. Elucidation of the x-ray diffraction spectrum (i.e., precise locations and relative intensities of peaks and variability thereof) of chrysotile. Assignment of the diffraction peaks to the crystal planes responsible for them, and interpretation in terms of crystallography of the effects of grinding, orientation, and sample preparation.

C. Investigation of the chemical properties of chrysotile, antigorite, chlorite, tremolite, and talc; specifically, measurement of the rates of hydrolytic and ion replacement reactions.

D. Microscopy, both optical and electron, of chrysotile and of talcs containing various accessory minerals, including chrysotile and tremolite.

E. Measurement of the degree of enrichment, due to air elutriation, of asbestos in the lightest fractions of the dust from commercial talcs.

F. Development of a method based on the combination of x-ray diffraction, chemical reactivity, and microscopy for the estimation of the chrysotile and tremolite contents of consumer products (these two being the only asbestiform minerals encountered in all the American products examined so far, with only one possible exception), and application of the method to the analysis of about 200 standard store-purchased specimens.

G. Investigation of alternative analytical methods, viz., differential thermal analysis and density gradient centrifugation, as alternative or supportive techniques.

Our results to date support the following conclusions:

1. The chrysotile that is found in commercial talcs is generally different in significant respects from the chrysotile that occurs as massive, fibrous growths in veins in serpentine rocks. That is, the former has diffraction peaks that may differ from the latter by as much as 0.2 A (at 7.3 A); it is more reactive toward dilute acids; it shows a different appearance under the microscope; and its DTA endotherms and exotherm are shifted relative to those of the latter (and apparently diminished).

2. The presence of chrysotile as a minor constituent in talc may be established with reasonable certainty on the basis of (a) the presence of x-ray diffraction peaks in the vicinity of 7.23 to 7.43 A and 3.59 to 3.65 A, (b) the pronounced weakening or complete disappearance of these peaks upon treatment ~~upon treatment~~ of the specimen with 1 M HCl at 80°C for 1 hour, (c) the presence of fiber bundles of visible size under 250× or higher magnification in the optical microscope which show a refractive index of about 1.54 (these fiber bundles may be short and straight, and may be coated with a bumpy encrustation of $MgCO_3$, or may be embedded in talc or other particles), and (d) the presence of fibers under the electron microscope which yield an electron diffraction pattern that corresponds in d-values to those found in the x-ray diffraction pattern (these fibers typically do not have a hollow central capillary running through them).

3. The concentration of chrysotile in a talc may be estimated by measuring the area under the x-ray diffraction peak at about 7.3 A relative to that of an internal standard. The best internal standard

is calcium oxalate monohydrate (peak at 5.83 A).

4. The quantitative results are conditioned by the fact that segregation effects in talc powders are considerable; the analytical method gives a reproducibility of ±2 to 3% average deviation in replicate determinations on the same sample, but different samples from the same bulk container are found to vary by as much as 200%.

5. The quantitative results are further complicated by the fact that antigorite gives an x-ray pattern that is indistinguishable from that of chrysotile. The HCl treatment specified above does not affect ground antigorite, but it is not yet known whether antigorite, if it occurs in talc, has the same chemical reactivity as the ground material from massive antigorite, or whether (like chrysotile) its properties may be variable depending upon the rock matrix in which it is found.

6. Subject to the qualifications inherent in the above, we have obtained quantitative estimates of the chrysotile contents of about 200 commercial talcum powder specimens. We have also determined the contents of the other minerals in these products, including tremolite, quartz, chlorite, dolomite, and others. There is no ambiguity in the identification of these latter species, but the quantitative results for these are also affected by the segregation problem, which is most serious for those constituents present in the smallest amounts.

7. Most of the commercial talcs tested are free of any detectable amount of any of the asbestiform minerals, according to the criteria enumerated above. Thus, there appears to be an adequate supply of talc for which there is no ambiguity about the absence of chrysotile or tremolite. In about 10% of the samples tested, there appear to be definitely detectable amounts of either chrysotile or tremolite present.

S. B. Lewis

TABLE IV

KEY TO SAMPLE NUMBERS OF COSMETIC TALCUM-TYPE POWDERS

SAMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
1	Ammens Powder, Medicated	Bristol-Myers (No. IF25)
2	Amolin Deodorant Powder	Norwich
3	Aquamarine Cooling Spray Bath Powder	Revlon (143)
4	Bagatelle Amber Dusting Powder	Corand (DCH)
5	Bourjois Bath Powder	
6	Caldesene Medicated Powder	Pennwalt (5274)
7	Cashmere Bouquet Body Powder	Colgate-Palmolive
8	Chanel No. 5 Bath Powder	
9	Countess Rocheau Cake Dusting Powder	Jergens
10	Crepe De Chine Dusting Powder, Millot	House of Fragrance (L1132)
11	Crepe De Chine Poudre Mist, Millot	House of Fragrance
12	Cuticura Talcum Powder	Purex (07170)
13	Desenex	WTS-Pharmacraft
14	Desitin Baby Powder	Pfizer (1139Z) (3/29/72)
15	Desitin Baby Powder	Pfizer (115A) (5/10/72)
16	Diaparene Baby Powder	Breon (E1030)
17	Dorothy Cray "Secret Of The Sea" Dusting Powder	
18	Emeraude Talcum Powder	Coty (355-4010)
19	English Leather	Mem
20	Faberge "Music" Dusting Powder	(2891)
21	Friendship Garden Dusting Powder	Shulton (3/27/72)
22	Friendship Garden Dusting Powder	Shulton (5/9/72)
23	Friendship Garden Dusting Powder	Shulton (7/13/72)

SAMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
24	Heaven Sent Aerosol Bath Powder Mist	Rubinstein
25	Heaven Sent Bath Powder	Rubinstein
26	Helen Pressl "Little Lady"	
27	Importa, Spain Mens' Talc	
28	Isis Floral Talcum Powder	
29	Johnson's Baby Powder	(028Q)
30	Johnson and Johnson Medicated Powder	(3612)
31	Koscot Beauty Dust--Oil of Mink	
32	Lanvin Arpege Dusting Powder	(1288)
33	Lanvin Arpege Powdered Mist	
34	Lanvin Arpege Talc	
35	Lewis Baby Powder	
36	Loves Fresh Lemon Glossy Powder	Manley & James
37	Macy's Scented Borated Talcum	
38	Macy's Talcum, Apple	(2K4)
39	Marcelle Dusting Powder, Hypo-Allergenic	
40	Mary Chess Perfumed Dusting Powder	
41	Mennen Baby Magic Powder	(B112)
42	Mennen Quinsana Foot Powder	(H202)
43	Merck Talc, Product No. 6460, Lot No. 6460)	(8039301)
44	Mexsana 2387-D Medicated Powder	Plough
45	Old Spice Body Talcum	Shulton
46	Persian Lilac Deluxe Dusting Powder	April Showers (LFN)
47	Persian Lilac Spray Bath Powder	April Showers (B200B)
48	Pond's Perfumed Talc Body Deodorant Dream Flower	(115B)
49	Prince Matchabelli Beloved Spray Powder	

SAMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
50	Quest Deodorant Powder	
51	Replique Spray Bath Powder	Parfums Raphael (004)
52	Riviana Foods - Italian Stearin Talc	For Rice
53	September Morn By Pond's	(19B)
54	Seven Winds After Bath Talc	DuBarry (021085)
55	U S P Talc	
56	Vaseline Intensive Care Baby Powder	(I 209)
57	Yves Saint Laurent Rive Gauche Spray Talc	
58	Z B T Baby Powder	(F1021)
59	Zeasorb Super Absorbent Medicated Powder	Stiefel
60	Ambush-Dana Dusting Powder	
61	April Showers	(9884)
62	Avon Unforgettable Perfumed Talc	
63	Beloved Perfumed Dusting Powder, Prince Matchabelli	
64	Coty Face Powder Rachel	
65	Desert Flower Spray Bath Powder	Shulton (F 1 BKI)
66	Emeraude Dusting Powder	Coty
67	Emeraude Spray Dusting Powder	Coty (1 AEY)
68	Fabergé Flambeau Deodorant Spray Powder	(37 WBF)
69	Jean Naté Spray Bath Powder	(1 N 247)
70	Jeris Talc, Flesh	
71	Jolie Madame Dusting Powder, Balmain	
72	Lady Esther Face Powder, Rachel	
73	Max Factor Face Powder, Rachelle	
74	Medicated Comfort Powder	Parke-Davis
75	Old de London Talc	Yardley (498)

SAMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
76	To Know Me Is To Love Me - Tinkerbell	Tom Fields, Ltd.
77	Touch And Glow Face Powder, Creamy Peach	Revlon
78	Toujours Moi Bath Powder	Corday
79	Yardley April Violets	(4908)
80	Chantilly Dusting Powder	Houbigant (11F)
81	Cashmere Bouquet	
82	Jean Nate Talc	(on 345)
83	Mennen Shave Talc	(B 81)
84	Shower To Shower Body Powder	Johnson & Johnson (5507BG)
85	Pure Baby Powder, Dart Drug	(K 11C)
86	Pond's Dream Flower Perfumed Talc	(O 13D)
87	Almay Hypo-Allergenic Face Powder	
88	Constance Carroll, Bouquet Talc	
89	Djer-Kiss Talcum	Kerkoff
90	Flamingo Dusting Powder, Tussy	(L1047)
91	Lander Lilacs And Roses Talc	
92	Mavis Talcum	Vivaudou
93	Mavis Body Powder	Vivaudou
94	Tangee	Luft-Tangee
95	ZBT Baby Powder	(B0048)
96	Blanchard's Dusting Powder	
97	Born Wild Dusting Powder	Del Labs
98	Lander Gardenia And Sweet Pea Talc	
99	Lander Lilacs And Roses Deodorant Body Talc	
100	Miss Dior Dusting Powder	
101	Tai Winds Spray Talc	(Avon (DCC 1272 2-14-72,HWS)

SAMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
102	Tosca Dusting Powder	
103	Coty L'Aimant Talcum Powder	(1JJ)
104	Coty Emeraude Talcum Powder	(01A)
105	Coty L'Aimant Dusting Powder	(1M)
106	Coty Imprévu Dusting Powder	(1DE)
107	Coty Muguet des Bois Dusting Powder	(2DO)
108	Revlon Intimate Perfumed Bath Powder	(241)
109	Jean Naté Bath Powder	Lanvin - Charles of the Ritz (2137)
110	Jean Naté Spray Bath Powder	Lanvin - Charles of the Ritz (2103)
111	Old Spice Body Talc	Shulton, Inc. (MFO)
112	Dr. Scholl's Foot Powder	(20517)
113	Faberge Xanadu Luxury Bath Powder Spray	(Y1)
114	Faberge Zizanie de Fragonard	(2132) Ref. 61159-019
115	Faberge Tigress Bath Powder	Ref. 2052-003
116	Faberge Woodhue for Men	Ref. 5027 (0252)
117	Faberge Brut for Men Shower Buff All-Over Body Powder	Ref. 5400
118	Faberge Talc	(raw material: from France)
119	Faberge Aphrodesia Bath Powder	Ref. 2052 (2172)
120	Faberge Straw Hat Bath Powder	
121	Faberge Aphrodesia for Men Shower Buff	Ref. 5027
122	Faberge Xanadu de Luxe Bath Powder	Ref. 1244-028 (2342)
123	Faberge Woodhue Bath Powder	Ref. 2052-002
124	Faberge Music Dusting Powder	Ref. 0714-018 (3121)
125	Faberge Flambeau Bath Powder	Ref. 2052 (3471)

SAMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
126	Mennen Baby Magic	
127	Walgreen's Crib Age	
128	Caldesene Medicated Powder	
129	Desiten	
130	Vaseline Intensive Care	
131	Johnson and Johnson Medicated Powder	
132	Johnson Baby Powder	
133	Johnson's Baby Powder	(108T)
134	Johnson's Baby Powder	(109T)
135	Johnson and Johnson Medicated Powder	(0452K)
136	Johnson and Johnson Shower to Shower Body Powder	(C 512Z)
137	Johnson and Johnson Shower to Shower Body Powder	(0709X1)
138	Johnson and Johnson Shower to Shower Body Powder	(0872K)
139	Avon Brocade Spray	(31602)
140	Avon Bird of Paradise Spray	(B1652)
141	Avon Tai Winds Spray Talc	(4065)
142	Mennen Bath Talc	(A308)
143	Tin-Zow Talque	Perfection Beauty Products, Inc., Pearl River, N.Y.
144	Overton's "High-Brown" Face Powder	
145	Softee Face Powder	
146	Westport Face Powder	
147	Hazel Bishop Pressed Powder	
148	Lady Wayne Face Powder	
149	Solitaire Cake Makeup	
150	Dreamglo Pressed Powder	

SAMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
151	Early American Old Spice Talcum Powder	
152	Corsage Dusting Powder	Lander
153	Ammens Powder, Medicated	
154	Bismoline Medicated Powder	
155	Rite Aid Pure Baby Powder	
156	Warner Pure Baby Powder	
157	Mavis Imported Talcum	
158	Avon Brocade Perfumed Talc	
159	Avon Blue Lotus Perfumed Talc	
160	Avon Beauty Dust Refill - Charisma	
161	Avon Elusive Beauty Dust Refill	
162	Avon Regence Perfumed Talc	
163	Pinaud Clubman Talc	
164	Grand Union Baby Powder	(101672)
165	Cashmere Bouquet	(4212DX) (Supplied by Mfgr.)
166	Almay Face Powder, Soft Beige	(List No. 719, Lot 201, Supplied by Mfgr.)
167	Tawny Tone Body Talc From Black Heritage	(Beauty Mustus, Inc. Greenwich, Conn.)
168	Colgate Tooth Powder	
169	Dr. Lyon's Tooth Powder	
170	"C" Bouquet Talc.	(Winarick, Inc. Distr. by F. W. Woolworth)(2662)
171	Tangee Dusting Powder	(George W. Luft Co.)(2762)
172	Jeris Talc	(Winarick) (2732)
173	Corsage Dusting Powder	(Lander Co.)
174	Lander Gardenia & Sweet Pea Deodorant Body Talc	

SAMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
175	Lander Baby Powder	
176	Lander Lilac & Roses Body Talc	
177	Beloved Perfumed Dusting Powder	Prince Matchabelli (235A)
178	Jean Nate Talc No. 60	(2264)
179	Jean Nate Spray Bath Powder	(2101)
180	Tinkerbell Body Talc	(Tom Fields, Ltd., Div. of MEM)
181	Yardley Sigh Shadow Brush-On Eye Shadow	Ref. No. 721
182	Max Factor Face Powder, Rachelle	(Supplied by Mfgr.)
183	Tweed Bath Powder, Lentheric	(Yardley)(44)
184	Yardley Next to Nature Sheer Pressed Powder	(A2)
185	Yardley April Violets Dusting Powder	(162)
186	Yardley Red Roses Dusting Powder	(165)
187	Yardley Springflowers Talc	(260)
188	Yardley White Lavender Talc	(271)
189	Yardley Red Roses Talc	(214)
190	April Showers Deodorant Talc	Ref. No. 9882
191	Chantilly Houbigant Dusting Powder	(2JBB)
192	Tinkerbell Dusting Powder	(Tom Fields, Ltd.)
193	Tinkerbell Powder Mitt	(Tom Fields, Ltd.)
194	Tinkerbell Dusting Powder	(Tom Fields, Ltd.)
195	Tinkerbell Body Talc	(Tom Fields, Ltd.)

TABLE I

FINAL REPORT

X-RAY POWDER DIFFRACTION ANALYSES OF COMMERCIAL COSMETIC POWDERS

Sample	Talc	Chlorite	Phlogopite	α-Quartz	Dolomite	Calcite	Tremolite	Chrysotile	Other Species
1	70%	3%	7%	n.d.	n.d.	n.d.	n.d.	n.d.	
2	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
3	99%	n.d.	1%	n.d.	n.d.	n.d.	n.d.	n.d.	
4	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
5	95%	2%	3%	n.d.	n.d.	n.d.	n.d.	n.d.	
6	80%	2%	5%	n.d.	n.d.	n.d.	n.d.	n.d.	CaUndecyl
7	86%	7%	2%	3%	2%	n.d.	n.d.	?	
8	95%	2%	3%	n.d.	n.d.	n.d.	n.d.	n.d.	
9	89%	7%	2%	2%	n.d.	n.d.	n.d.	n.d.	
10	93%	3%	2%	2%	n.d.	n.d.	n.d.	n.d.	
11	90%	2%	2%	4%	2%	n.d.	n.d.	n.d.	
12	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
13	60%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	ZnUndecyl
14	31%	50%	2%	10%	7%	n.d.	n.d.	n.d.	
15	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
16	--	--	--	--	--	--	--	--	Kaolin, Starch
17	60%	30%	4%	n.d.	6%	n.d.	n.d.	n.d.	
18	90%	4%	2%	2%	2%	n.d.	n.d.	n.d.	
19	97%	1%	2%	n.d.	n.d.	n.d.	n.d.	n.d.	
20	35%	60%	1%	4%	n.d.	n.d.	n.d.	n.d.	
21	67%	25%	2%	3%	3%	n.d.	n.d.	n.d.	
22	59%	35%	1%	n.d.	5%	n.d.	n.d.	n.d.	
23	42%	50%	2%	3%	3%	n.d.	n.d.	?	
24	94%	1%	2%	3%	n.d.	n.d.	n.d.	n.d.	
25	95%	2%	3%	n.d.	n.d.	n.d.	n.d.	?	
26	95%	1%	4%	n.d.	n.d.	n.d.	n.d.	?	
27	78%	n.d.	2%	n.d.	20%	n.d.	n.d.	n.d.	
28	ca.20%	1%	n.d.	n.d.	n.d.	10%	n.d.	n.d.	Kaolin, Mica
29	ca.94%	n.d.	2%	n.d.	2%	n.d.	n.d.	n.d.	Kaolin
30	97%	1%	2%	n.d.	n.d.	n.d.	n.d.	n.d.	
31	47%	50%	2%	3%	3%	n.d.	n.d.	n.d.	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

ample	Talc	Chlorite	Phlogo-pite	α-Quartz	Dolo-mite	Calcite	Trem-olite	Chryso-tile	Other Species
33	55%	40%	2%	n.d.	3%	n.d.	n.d.	n.d.	
34	78%	7%	4%	3%	8%	n.d.	n.d.	n.d.	
35	78%	5%	2%	10%	5%	n.d.	n.d.	n.d.	
36	ca.81%	4%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	Mica
37	38%	50%	5%	n.d.	7%	n.d.	n.d.	n.d.	
38	87%	5%	4%	2%	2%	n.d.	n.d.	n.d.	
39	94%	3%	n.d.	3%	n.d.	n.d.	n.d.	n.d.	
40	67%	25%	n.d.	3%	5%	n.d.	n.d.	n.d.	
41	83%	8%	2%	2%	5%	n.d.	n.d.	n.d.	
42	89%	6%	n.d.	n.d.	3%	2%	n.d.	n.d.	
43	97%	n.d.	n.d.	3%	n.d.	n.d.	n.d.	n.d.	
44	--	--	--	--	--	--	--	--	ZnO, Kaolin
45	66%	30%	n.d.	n.d.	4%	n.d.	n.d.	n.d.	
46	48%	40%	n.d.	5%	7%	n.d.	n.d.	n.d.	
47	98%	n.d.	n.d.	n.d.	n.d.	2%	n.d.	n.d.	
48	88%	4%	2%	2%	4%	n.d.	n.d.	n.d.	
49	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
50	95%	5%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
51	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
52	87%	8%	2%	3%	n.d.	n.d.	n.d.	n.d.	
53	90%	4%	2%	2%	2%	n.d.	n.d.	n.d.	
54	ca.87%	3%	4%	n.d.	4%	n.d.	n.d.	?	
55	80%	15%	n.d.	5%	n.d.	n.d.	n.d.	n.d.	
56	90%	7%	n.d.	3%	n.d.	n.d.	n.d.	n.d.	
57	80%	15%	n.d.	n.d.	5%	n.d.	n.d.	n.d.	
58	96%	n.d.	n.d.	4%	n.d.	n.d.	n.d.	n.d.	
59	ca.90%	n.d.	n.d.	3%	n.d.	n.d.	n.d.	n.d.	Starch
60	ca.60%	30%	n.d.	n.d.	7%	2%	n.d.	n.d.	ZnStear.
61	38%	40%	n.d.	4%	18%	n.d.	n.d.	n.d.	
62	85%	2%	n.d.	3%	n.d.	10%	n.d.	n.d.	
63	87%	2%	2%	4%	n.d.	n.d.	5%	n.d.	
64	ca.80%	5%	3%	2%	3%	n.d.	n.d.	n.d.	ZnStear.
65	ca.78%	15%	n.d.	n.d.	4%	n.d.	n.d.	n.d.	ZnStear.
66	84%	5%	3%	3%	3%	n.d.	n.d.	2%	
67	78%	15%	n.d.	n.d.	5%	n.d.	2%	n.d.	
68	80%	15%	n.d.	n.d.	5%	n.d.	n.d.	n.d.	
69	97%	[illegible]	n.d.	n.d.	n.d.	2%	n.d.	n.d.	

ample	Talc	Chlorite	Phlogo-pite	α-Quartz	Dolo-mite	Calcite	Trem-olite	Chryso-tile	Other Species
70	28%	60%	n.d.	5%	7%	n.d.	n.d.	n.d.	
71	85%	10%	n.d.	2%	n.d.	n.d.	3%	n.d.	
72	86%	5%	3%	4%	n.d.	2%	n.d.	n.d.	
73	ca. 80%	10%	n.d.	3%	5%	n.d.	n.d.	n.d.	ZnStear.
74	90%	n.d.	n.d.	n.d.	5%	5%	n.d.	n.d.	
75	75%	5%	n.d.	n.d.	15%	5%	n.d.	n.d.	
76	75%	n.d.	5%	5%	10%	n.d.	5%	n.d.	
77	91%	n.d.	4%	2%	n.d.	n.d.	3%	n.d.	
78	85%	2%	1%	4%	3%	n.d.	5%	n.d.	
79	81%	5%	4%	n.d.	2%	8%	n.d.	n.d.	
30	ca. 50%	40%	n.d.	5%	n.d.	n.d.	n.d.	?	
31	ca. 80%	7%	1%	6%	4%	n.d.	n.d.	?	
32	ca. 78%	12%	2%	4%	3%	n.d.	n.d.	?	
33	ca. 84%	6%	5%	n.d.	4%	n.d.	n.d.	?	
34	ca. 92%	4%	n.d.	n.d.	3%	n.d.	n.d.	?	
35	ca. 86%	5%	n.d.	n.d.	8%	n.d.	n.d.	?	
36	85%	4%	2%	4%	4%	n.d.	n.d.	?	
37	ca. 30%	50%	n.d.	4%	12%	3%	n.d.	?	
38	61%	n.d.	n.d.	5%	25%	n.d.	4%	5%	
39	68%	1%	3%	8%	10%	n.d.	5%	5%	
10	55%	n.d.	3%	7%	25%	2%	3%	5%	
11	ca. 50%	1%	n.d.	n.d.	3%	5%	n.d.	5%	Mica
12	64%	n.d.	n.d.	6%	20%	n.d.	5%	5%	
13	55%	1%	4%	6%	25%	n.d.	5%	4%	
14	ca. 46%	4%	3%	6%	35%	n.d.	4%	?	
15	86%	n.d.	n.d.	5%	4%	n.d.	2%	3%	
16	28%	n.d.	3%	6%	45%	n.d.	8%	10%	
17	31%	1%	1%	5%	35%	n.d.	12%	15%	
8	ca. 40%	n.d.	3%	n.d.	6%	2%	n.d.	n.d.	Kaolin, Mica
9	ca. 40%	n.d.	3%	n.d.	6%	2%	n.d.	n.d.	Kaolin, Mica
0	ca. 80	10%	4%	n.d.	2%	n.d.	n.d.	n.d.	ZnStear.
1	63%	8%	3%	7%	4%	n.d.	15%	n.d.	
2	63%	2%	n.d.	3%	15%	n.d.	10%	7%	
3	93%	3%	n.d.	n.d.	4%	n.d.	n.d.	n.d.	
4	91%	3%	1%	2%	3%	n.d.	n.d.	n.d.	

Sample	Talc	Chlorite	Phlogopite	α-Quartz	Dolomite	Calcite	Tremolite	Chrysotile	Other Species
105	92%	3%	1%	2%	2%	n.d.	n.d.	n.d.	
106	91%	3%	1%	3%	2%	n.d.	n.d.	n.d.	
107	87%	5%	2%	n.d.	6%	n.d.	n.d.	n.d.	
108	81%	10%	2%	2%	3%	n.d.	2%	n.d.	
109	74%	15%	3%	3%	3%	n.d.	2%	?	Kaolin
110	99%	n.d.	1%	n.d.	n.d.	n.d.	n.d.	n.d.	
111	42%	40%	2%	n.d.	15%	n.d.	1%	n.d.	
112	ca.60%	n.d.	n.d.	4%	n.d.	10%	n.d.	n.d.	Salicylic Ac., Boric
113	75%	15%	n.d.	3%	7%	n.d.	n.d.	n.d.	
114	53%	40%	n.d.	3%	4%	n.d.	n.d.	n.d.	
115	53%	40%	n.d.	3%	4%	n.d.	n.d.	n.d.	
116	53%	40%	n.d.	3%	4%	n.d.	n.d.	n.d.	
117	42%	35%	n.d.	15%	4%	2%	n.d.	?	
118	53%	40%	n.d.	3%	4%	n.d.	n.d.	n.d.	
119	49%	40%	n.d.	6%	5%	n.d.	n.d.	n.d.	
120	46%	40%	n.d.	8%	4%	n.d.	n.d.	?	
121	87%	8%	2%	n.d.	3%	n.d.	n.d.	n.d.	
122	56%	35%	n.d.	5%	4%	n.d.	n.d.	?	
123	51%	40%	n.d.	3%	4%	n.d.	n.d.	?	
124	54%	40%	n.d.	3%	3%	n.d.	n.d.	?	
125	55%	40%	n.d.	2%	3%	n.d.	n.d.	?	
126	75%	10%	3%	4%	8%	n.d.	n.d.	n.d.	
127	85%	n.d.	n.d.	4%	n.d.	n.d.	n.d.	n.d.	Boric Acid
128	60%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	CaUndecyl.
129	97%	n.d.	n.d.	n.d.	3%	n.d.	n.d.	n.d.	
130	ca.88%	7%	n.d.	2%	3%	n.d.	trace	trace	
131	ca.92	3%	3%	n.d.	2%	n.d.	trace	n.d.	
132	95%	3%	2%	n.d.	n.d.	n.d.	n.d.	n.d.	
133	94%	2%	4%	n.d.	n.d.	n.d.	n.d.	n.d.	
134	93%	3%	2%	n.d.	2%	n.d.	n.d.	n.d.	
135	93%	2%	3%	n.d.	2%	n.d.	n.d.	n.d.	
136	89%	4%	3%	2%	2%	n.d.	n.d.	n.d.	
137	91%	4%	n.d.	3%	2%	n.d.	n.d.	n.d.	
138	85%	7%	3%	2%	3%	n.d.	n.d.	n.d.	
139	ca.85%	n.d.	n.d.	2%	n.d.	n.d.	n.d.	n.d.	ZnStear. $MgCO_3$
140	ca.85%	n.d.	n.d.	2%	1%	n.d.	n.d.	n.d.	ZnStear. $MgCO_3$

Sample	Talc	Chlorite	Phlogopite	α-Quartz	Dolomite	Calcite	Tremolite	Chrysotile	Other Species
141	80%	n.d.	n.d.	2%	1%	n.d.	n.d.	n.d.	ZnStear, $MgCO_3$
142	79%	7%	5%	4%	5%	n.d.	n.d.	n.d.	
143	55%	2%	n.d.	3%	25%	n.d.	5%	10%	
144	ca.70%	10%	n.d.	6%	n.d.	n.d.	5%	?	ZnStear. Kaolin
145	ca.70%	3%	n.d.	n.d.	3%	n.d.	n.d.	2%	ZnStear. Kaolin, ZnO
146	ca.85%	n.d.	n.d.	4%	n.d.	5%	n.d.	n.d.	ZnStear.
147	ca.85%	n.d.	n.d.	n.d.	n.d.	5%	n.d.	n.d.	Kaolin
148	ca.45%	40%	n.d.	n.d.	8%	n.d.	2%	n.d.	ZnStear.
149	ca.50%	10%	n.d.	10%	12%	n.d.	8%	?	Kaolin
150	80%	2%	n.d.	5%	n.d.	5%	n.d.	n.d.	Kaolin
151	63%	25%	n.d.	2%	10%	n.d.	n.d.	n.d.	
152	ca.70%	2%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	Pyrophyllite
153	ca.80%	2%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	ZnO, Boric Acid
154	ca.70%	10%	4%	4%	2%	n.d.	2%	n.d.	ZnO
155	ca.84%	10%	n.d.	4%	2%	n.d.	n.d.	?	
156	79%	10%	n.d.	6%	3%	n.d.	2%	n.d.	
157	63%	2%	n.d.	3%	18%	n.d.	6%	8%	
158	78%	7%	n.d.	3%	2%	10%	n.d.	n.d.	
159	ca.74%	10%	2%	n.d.	4%	10%	n.d.	?	
160	60%	25%	n.d.	n.d.	4%	10%	n.d.	trace	
161	59%	25%	n.d.	2%	4%	10%	n.d.	n.d.	
162	50%	25%	n.d.	2%	5%	10%	n.d.	n.d.	
163	55%	2%	n.d.	3%	20%	n.d.	10%	10%	
164	92%	3%	2%	n.d.	2%	n.d.	n.d.	1%	
165	92%	5%	n.d.	n.d.	2%	n.d.	n.d.	?	
166	ca.50%	40%	n.d.	2%	8%	n.d.	n.d.	?	
167	76%	10%	n.d.	n.d.	12%	n.d.	2%	n.d.	
168	--	--	--	--	--	--	--	--	Gypsum
169	--	--	--	--	--	ca.80%	--	--	
170	82%	n.d.	n.d.	5%	25%	n.d.	n.d.	8%	
171	70%	10%	n.d.	5%	15%	n.d.	n.d.	n.d.	
172	43%	50%	n.d.	n.d.	5%	n.d.	2%	n.d.	
173	ca.99%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	?	
174	ca.60%	1%	2%	15%	n.d.	n.d.	n.d.	n.d.	Kaolin, Mica

Sample	Talc	Chlorite	Phlogo-pite	α-Quartz	Dolo-mite	Calcite	Trem-olite	Chryso-tile	Other Species
175	ca.86%	3%	n.d.	10%	n.d.	n.d.	n.d.	?	
176	ca.79%	3%	2%	15%	n.d.	n.d.	n.d.	?	
177	84%	10%	4%	2%	n.d.	n.d.	n.d.	n.d.	
178	ca.50%	20%	2%	5%	4%	n.d.	n.d.	?	Kaolin
179	97%	n.d.	n.d.	3%	n.d.	n.d.	n.d.	n.d.	
180	88%	n.d.	n.d.	n.d.	12%	n.d.	n.d.	n.d.	
181	ca.70%	n.d.	n.d.	n.d.	n.d.	10%	n.d.	n.d.	Kaolin
182	ca.40%	25%	15%	n.d.	n.d.	n.d.	n.d.	?	ZnO
183	ca.76%	10%	n.d.	n.d.	2%	10%	1%	?	
184	93%	2%	n.d.	2%	n.d.	n.d.	3%	n.d.	
185	ca.50%	8%	n.d.	n.d.	n.d.	25%	n.d.	n.d.	ZnO
186	ca.50%	5%	n.d.	n.d.	n.d.	25%	n.d.	?	ZnO
187	ca.85%	5%	n.d.	2%	n.d.	5%	2%	n.d	
188	70%	15%	2%	3%	4%	5%	1%	?	
189	72%	12%	n.d.	3%	2%	5%	1%	n.d.	
190	ca.82%	12%	2%	n.d.	3%	n.d.	n.d.	?	
191	96%	2%	n.d.	n.d.	2%	n.d.	n.d.	n.d.	
192	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
193	ca.93%	2%	n.d.	2%	2%	n.d.	n.d.	?	ZnStear.
194	ca.94%	2%	n.d.	n.d.	3%	3%	n.d.	?	
195	97%	n.d.	n.d.	n.d.	3%	n.d.	n.d.	n.d.	