TEMANEX REPORT

TN-875

NORTH AMERICAN WEST COAST PIGMENT MARKETS WITH EMPHASIS ON TALC PROSPECTS

Prepared by: G. N. Ionides
TEMANEX CONSULTING INC.
1403 Bewicke Avenue
North Vancouver, B.C.
CANADA
V7M 3C7

May 31, 1988

ACKNOWLEDGEMENT

Financial assistance for this study was provided jointly by the Department of Energy, Mines and Petroleum Resources of Canada and the Ministry of Energy, Mines and Petroleum Resources of British Columbia under the Canada/British Columbia Mineral Development Subsidiary Agreement.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION AND EXECUTIVE SUMMARY

This report was prepared at the request of Pacific Talc Ltd. (Mr. C.J. Parmentier). It analyzes papermaking mineral pigments market trends in Western North America, (actually West Coast where the paper industry is) with special emphasis on talc potential and current limitations.

Talc usage in papermaking in North America is very limited, unlike Western Europe. Total talc usage on the West Coast is in the range 15-20 thousand tonnes/year, but 4/5 of this is for pitch control, with only about 3 thousand tonnes/year actually being used for paper filling and coating. The major inhibiting forces have been the availability of relatively low cost kaolin from Georgia, and problems with talc dispersion as well as high dusting tendency in offset printing of papers containing talc. These problems originiate from the hydrophobic nature of the talc's surface. The kaolin cost advantage is much lower on the West Coast because of high (about US $70-75/tonne) transport costs which are added to the pigment cost.

Pure talc on the other hand has some very positive attributes, namely high brightness, up to about 95%, low abrasiveness and high aspect (diameter to thickness) ratio, which enhances the development of surface smoothness and gloss. The Western Europeans, who use roughly the same total papermaking pigments tonnage as the North Americans, use about three times as much talc, mostly to enhance product quality, rather than for pitch control. Thus, there is a significant potential for increased talc usage since it is an established technology.

The major inhibiting factor, however, still remains the hydrophobic nature of the talc's surface, which results in high dusting tendency in offset printing. Offset is the dominant printing process in North America, commanding roughly a 50% share of total printing activity. If this problem is eliminated, it should be, in principle, possible for talc to capture a significant share of the West Coast papermaking mineral pigments market. For this it must also be priced lower than alternative, comparable quality pigments (kaolin and calcium carbonate). Provided these conditions are met, it should be possible for talc to capture roughly a 20% share of the West Coast pigments market over the next 5-10 years, reaching about 130-140 thousand tonnes/year by 1995.

2 GENERAL WEST COAST MINERAL PIGMENT MARKET

2.1 MARKET SIZE AND BREAKDOWN OF MINERAL PIGMENT MARKET

From the Western North American mineral pigment market, only the coastal states have paper industry. Figure 2-1 shows the major extender and filler mineral markets in western North America.

Figures 2-2 and 2-3 show the consumption of all the extender and filler pigments used in 1984, a breakdown of the different markets and a breakdown of the different mineral pigments used in the paper industry (from the 8% "other" approximately 4% is talc).

Listed below in Table 2-1 is the total consumption of the main mineral pigments in the region.

TABLE 2-1

WEST COAST MINERAL PIGMENT CONSUMPTION - 1987

	KAOLIN (tonnes)	CARBONATE (tonnes)	TALC (tonnes)
Paint	30,000	N/A	26,000
Paper	295,000	145,000	17,000
Others	50,000	N/A	22,000
Total	375,000	366,000	65,000

80% of the talc used by the paper industry is used for pitch controlling ($\sim$ 14,000 tonnes), and only 20% for paper filling and coating ($\sim$ 3,000 tonnes). That means that talc used for filling and coating currently represents only approximately 0.7% of all filler and coating pigments used by the paper industry.

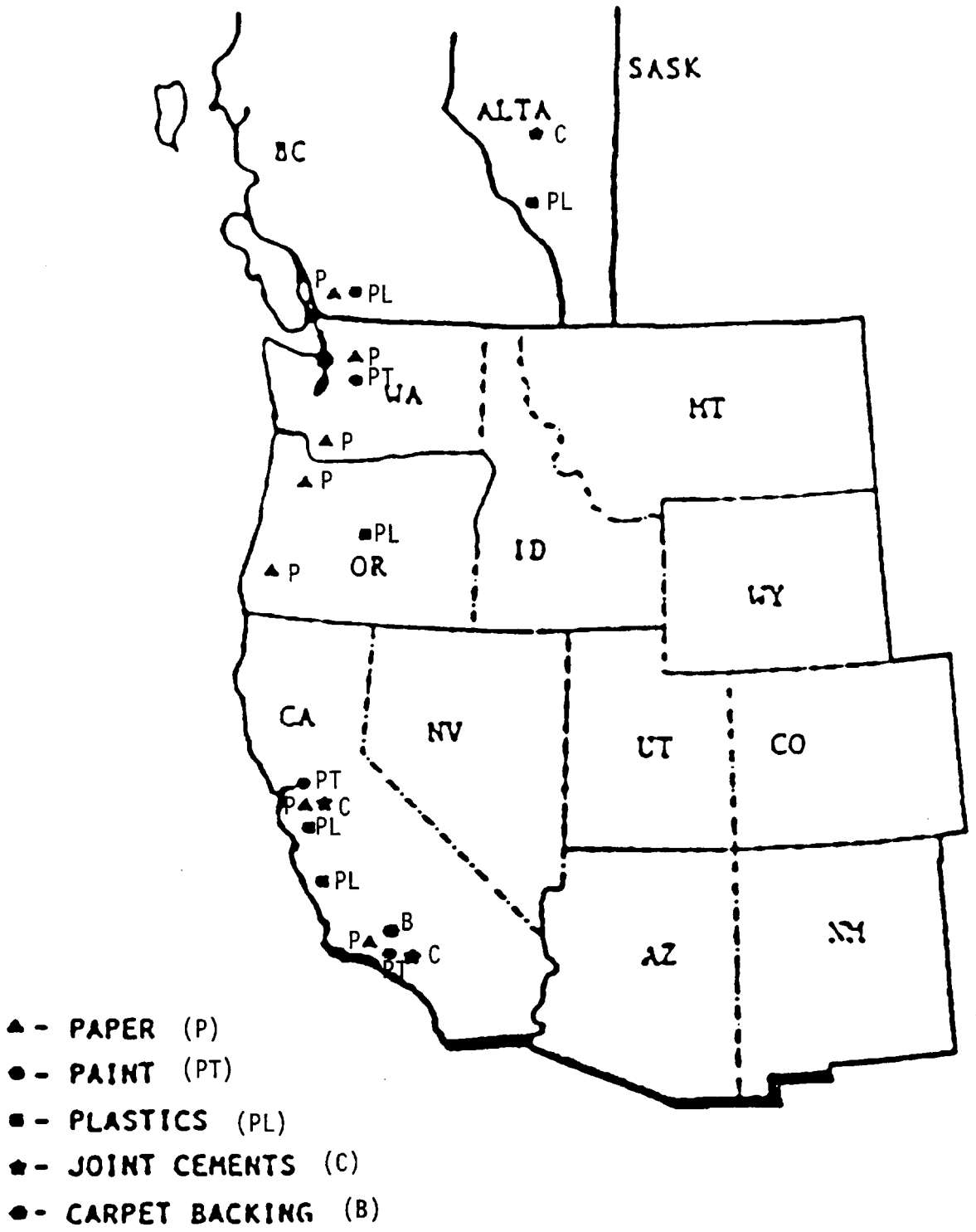


FIGURE 2-1 MAJOR EXTENDER AND FILLER MINERAL MARKETS IN WESTERN NORTH AMERICA

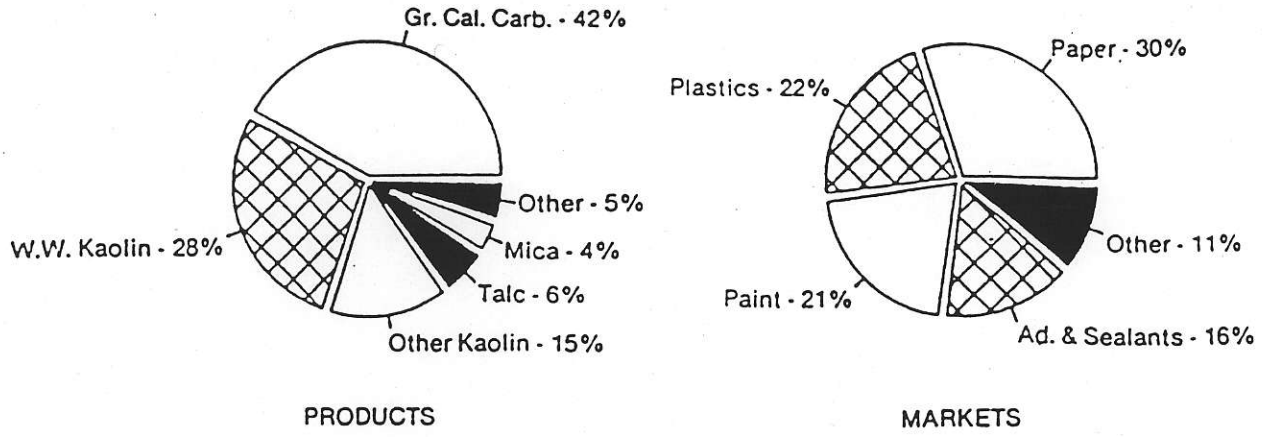


FIGURE 2-2 ESTIMATED CONSUMPTION OF EXTENDER AND FILLER MINERALS IN WESTERN NORTH AMERICA; 1987 CONSUMPTION ABOUT 950 THOUSAND TONNES

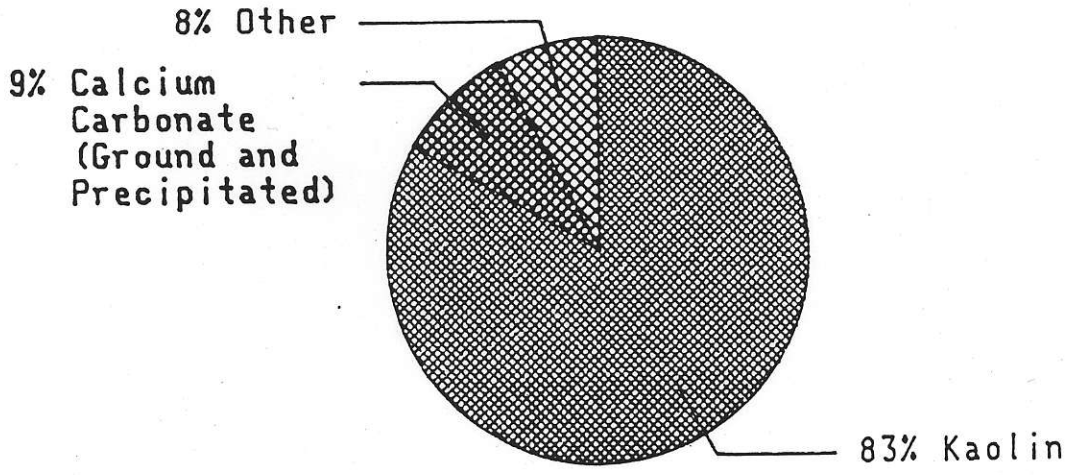


FIGURE 2-3 NORTH AMERICAN CONSUMPTION OF EXTENDER AND FILLER PIGMENTS IN THE PAPER INDUSTRY; 1987 ESTIMATE 4.2 MILLION TONNES

2.2 MARKET SIZE OF THE END USE MARKET PULP AND PAPER

It is important to understand how the mineral pigment market is related to end use markets. Approximately 70% of all extender and filler pigments used by the pulp and paper industry on the North American West Coast are used for information papers (Uncoated and Coated Mechanical, Uncoated and Coated Woodfree, and recently Newsprint). The rest is more or less used for packaging paper (board). The percentage for the U.S. would be 90% information papers and 10% packaging. The reason for the differences in the percentage of the different mineral pigment usages from the West Coast paper industry to the U.S. industry is to be found in a higher production of coated paperboard in the West, and lower printing and writing.

Tables 2-2 to 2-4 show a breakdown of the West Coast information paper production by the different areas and companies.

The West Coast newsprint production accounts for nearly 3.5 million metric tonnes/year. With 56% or 1.9 million metric tonnes, B.C. is the region on the West Coast with the highest newsprint production. It should be noted that at least five new newsprint machines will be commissioned in B.C., Alberta and Washington by 1990-91, raising the total annual capacity by an additional 1-1.1 million tonnes. The total annual amount of fine paper production on the North American West Coast is 1.4 million metric tonnes. The largest producing region is Washington, with approximately 600,000 metric tonnes or 43% of total, whereas B.C. with its 135,000 metric tonnes or 10% of total, represents the smallest producing region.

TABLE 2-2

WEST COAST NEWSPRINT PRODUCTION CAPACITY - 1987

	COMPANY	LOCATION	NUMBER OF MACHINES	PAPER PRODUCTION CAPACITY/YEAR '000 METRIC TONNES
BRITISH COLUMBIA	MACMILLAN BLOEDEL	POWELL RIVER	6	732
	MACMILLAN BLOEDEL	PORT ALBERNI	3	363
	CROWN FOREST	ELK FALLS	4	428
	BCFP	CROFTON	3	393
	SUBTOTAL			1916
WASHINGTON	NORPAC	LONGVIEW	2	371
	BOISE CASCADE	STEILACOOM	2	162
	INLAND EMPIRE	SPOKANE	1	89
	CROWN ZELLERBACH	PORT ANGELES	3	161
	SUBTOTAL			783
OREGON	SMURFIT	NEWBERG	2	321
	SMURFIT	OREGON CITY	3	197
	CROWN ZELLERBACH	CLATSKANIE	1	125
	SUBTOTAL			643
CALIFORNIA	GARDEN STATE	POMONA	1	121
	SUBTOTAL			121
TOTAL			31	3463

TABLE 2-3

WEST COAST FINE PAPER PRODUCTION - 1987

	COMPANY	LOCATION	NUMBER OF MACHINES	PAPER PRODUCTION CAPACITY/YEAR '000 METRIC TONNES	
BRITISH COLUMBIA	ISLAND PAPER MILLS	NEW WESTMINSTER	2	136	
	SUBTOTAL			136	
WASHINGTON	CROWN ZELLERBACH	CAMAS	2	130	
	BOISE CASCADE	VANCOUVER	2	98	
	R-W PAPERS	LONGVIEW	2	107	
	BOISE CASCADE	WALLULA	2	143	
	GREYS HARBOUR PAPER	HOQUIAM	2	114	
	SUBTOTAL			592	
OREGON	CROWN ZELLERBACH	CLATSKANIE	1	68	
	BOISE CASCADE	SAINT HELENS	2	203	
	CROWN ZELLERBACH	WEST LINN	3	62	UNCOATED
				100	COATED
	SUBTOTAL			433	
CALIFORNIA	SIMPSON PAPER	ANDERSON	2	59	UNCOATED
				59	COATED
	SIMPSON PAPER	POMONA	2	107	
	SIMPSON PAPER	RIPON	1	29	
	SUBTOTAL			259	
TOTAL			23	1415	

TABLE 2-4

SUMMARY: PAPER PRODUCTION CAPABILITY
('000 METRIC TONNES PER ANNUM)

	NEWSPRINT	FINE PAPERS	COATED GRADES
BRITISH COLUMBIA	1916	136	-
WASHINGTON	783	592	-
OREGON	643	433	100
CALIFORNIA	121	254	59
TOTAL	3463	1415	159

2.3 GENERAL MARKET TRENDS

Following production trends in the paper industry (e.g. see U.S. in Table 2-5), the demand for filling and coating mineral pigments is reaching a record level.

Since 90% of the mineral pigments used in the U.S. (and ~ 70% on the North American Weat Coast) are used for information papers, i.e. newsprint and printing and writing, the increase of the demand for these pigments is dependent on the growth rate of these papers. Figure 2-4A,B shows that the global increase in demand of these papers is above average. Coated Mechanical and Coated Woodfree printing and writing are leading by far with 4-5% annual growth rate. They are followed by Uncoated Woodfree and Uncoated Mechanical printing and writing with an annual growth rate of approximately 3-3.5%. Table 2-6 shows a breakdown of the different printing processes for these papers. This information is necessary to understand some reasons for the relatively low talc usage in paper coating and filling - see below.

Accordingly, Figure 2-5 shows the North American consumption trends for the main mineral pigments. The increase in utilization of kaolin and calcium carbonate is very clearly shown. These two pigments share over 90% of the whole pigment market. Talc is also expected to exhibit an increase in demand, but titanium dioxide is limited to very tight supply and high prices.

TABLE 2-5
PAPER AND PAPERBOARD PRODUCTION BY GRADE, TOTAL UNITED STATES
1959-1987 (000 TONS)

	1959	1969	1979	1984	1985	1986	1st Half 1987 1/	% Per Year Growth 1959-1969	1969-1979	1979-1986	1984-1986	1st Half 1987/1986
PAPER & PAPERBOARD												
Newsprint	1,964	3,362	4,062	5,539	5,428	5,630	5,717	5.5	1.9	4.8	0.8	2.4
Printing/Writing	6,907	11,157	15,319	18,383	18,423	19,601	20,192	4.9	3.2	3.6	3.3	4.8
Packaging & Industrial Converting & Special Industrial 3/	4,026	5,305	5,740	5,586	5,204	5,117	5,110	2.8	0.8	-1.6	-4.3	-0.6
Tissue	2,128	3,611	4,520	4,921	4,941	5,095	5,213	5.4	2.3	1.7	1.8	2.1
Total Paper	15,025	23,435	29,641	34,429	33,996	35,443	36,232	4.5	2.4	2.6	1.5	3.2
Kraft Paperboard Unbl., Total	5,214	11,816	15,151	17,185	16,368	17,689	18,472	8.5	2.5	2.2	1.5	5.6
Linerboard	4,960	10,894	13,952	16,037	15,183	16,402	17,130	8.2	2.5	2.3	1.1	6.0
Semichemical Paperboard	1,774	3,696	4,689	5,169	5,088	5,376	5,604	7.6	2.4	2.0	2.0	5.6
Solid Bleached Paperboard	2,000	3,541	3,998	4,048	3,948	4,271	4,405	5.9	1.2	0.9	2.7	3.1
Recycled Paperboard	6,984	7,322	7,591	7,637	7,630	8,083	8,549	0.5	0.4	0.9	2.9	5.3
Total Paperboard	15,972	26,376	31,429	34,039	33,034	35,419	37,030	5.1	1.8	1.7	2.0	5.2
Total Paper plus Paperboard	30,997	49,811	61,070	68,468	67,030	70,862	73,262	4.9	2.1	2.1	1.7	4.2
Construction 2/ Other	2,751	3,103	3,275	1,800	1,800 E	1,800 E	1,855 E	4.6	0.5	-8.2	0.0	0.0
TOTAL ALL GRADES	33,748	52,914	64,345	70,268	68,830	72,662	75,117	4.6	2.0	1.8	1.7	4.1
TOTAL WOOD PULP	24,383 3/	42,813 3/	50,533	55,470	54,147	57,268	58,740 *	5.8	1.7	1.8	1.6	5.0
MARKET WOOD PULP	2,581	4,855	5,678	6,898	6,800	7,567	7,812 *	6.5	1.6	4.2	4.7	4.1

1/ Annual rates not seasonally adjusted — Estimated by API
2/ 1959-1979 BUREAU OF THE CENSUS; 1984-1986 ESTIMATES BY API
3/ Includes wood pulp for construction grades
* Jan-May

SOURCE: American Paper Institute, except as noted

American Paper Institute
Economics Department
August, 1987

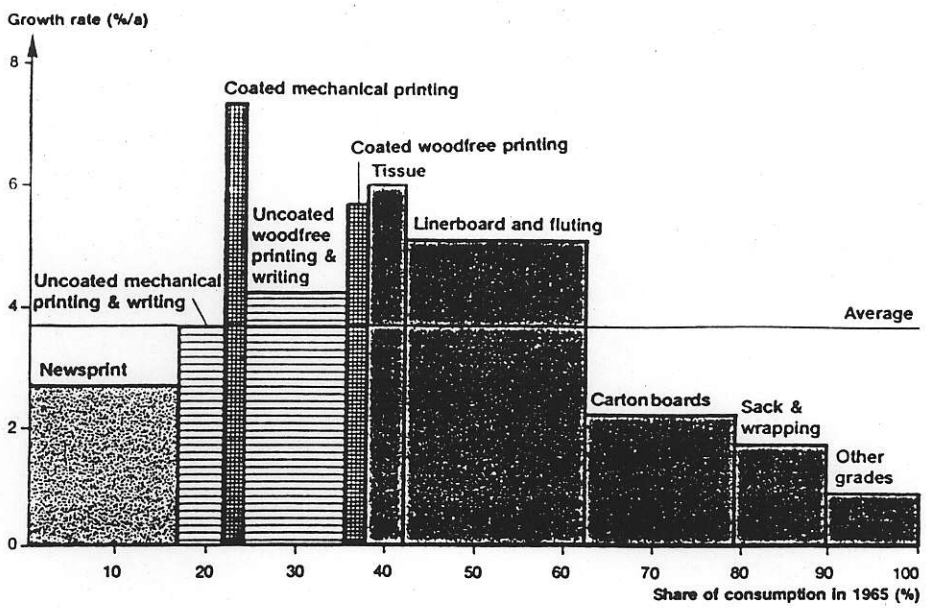


FIGURE 2-4A GROWTH RATE OF PAPER AND BOARD CONSUMPTION IN THE WORLD - 1965-1984

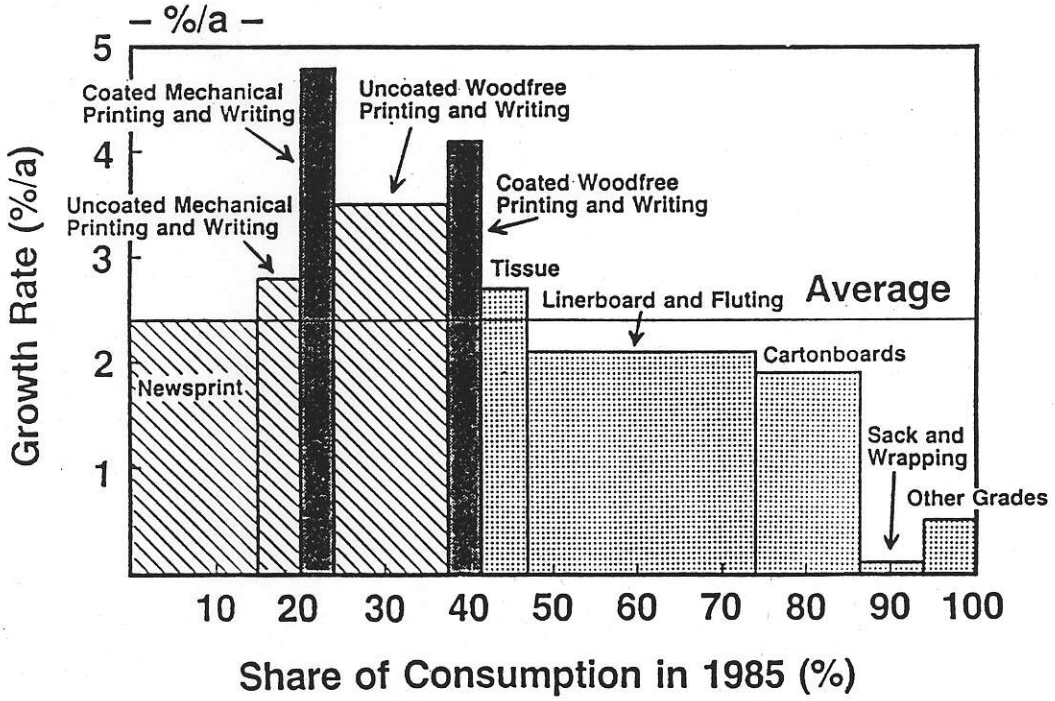


FIGURE 2-4B GROWTH RATE OF PAPER AND BOARD CONSUMPTION IN THE WORLD - 1985-2000

TABLE 2-6

PRINTING PAPERS PRINTING PROCESS
BREAKDOWN IN NORTH AMERICA

	COLDSET OFFSET		HEATSET OFFSET		ROTOGRAVURE		OTHER		MILLION TONNES/YR N. AMERICA
	%	MIL. T	%	MIL. T	%	MIL. T	%	MIL. T	T
NEWSPRINT	65	8-8.5	-	-	-	-	35	4-4.5	12-13
UNCOATED GROUNDWOOD	30	1.2	25	1	35	1.4	10	0.4	4
COATED GROUNDWOOD	-	-	70	3	20	0.9	10	0.4	4-4.5
UNCOATED WOODFREE*	25	2.7	-	-	-	-	75*	7.7	10-11
COATED WOODFREE	-	-	60	1.8	-	-	40	1.2	3
TOTAL	35	12.1	17	5.8	7	2.3	41	14	39.2

* THIS IS A SPECIAL GRADE, WITH MUCH TONNAGE USED IN BUSINESS PAPERS (PHOTOCOPY, ENVELOPES, ETC.)

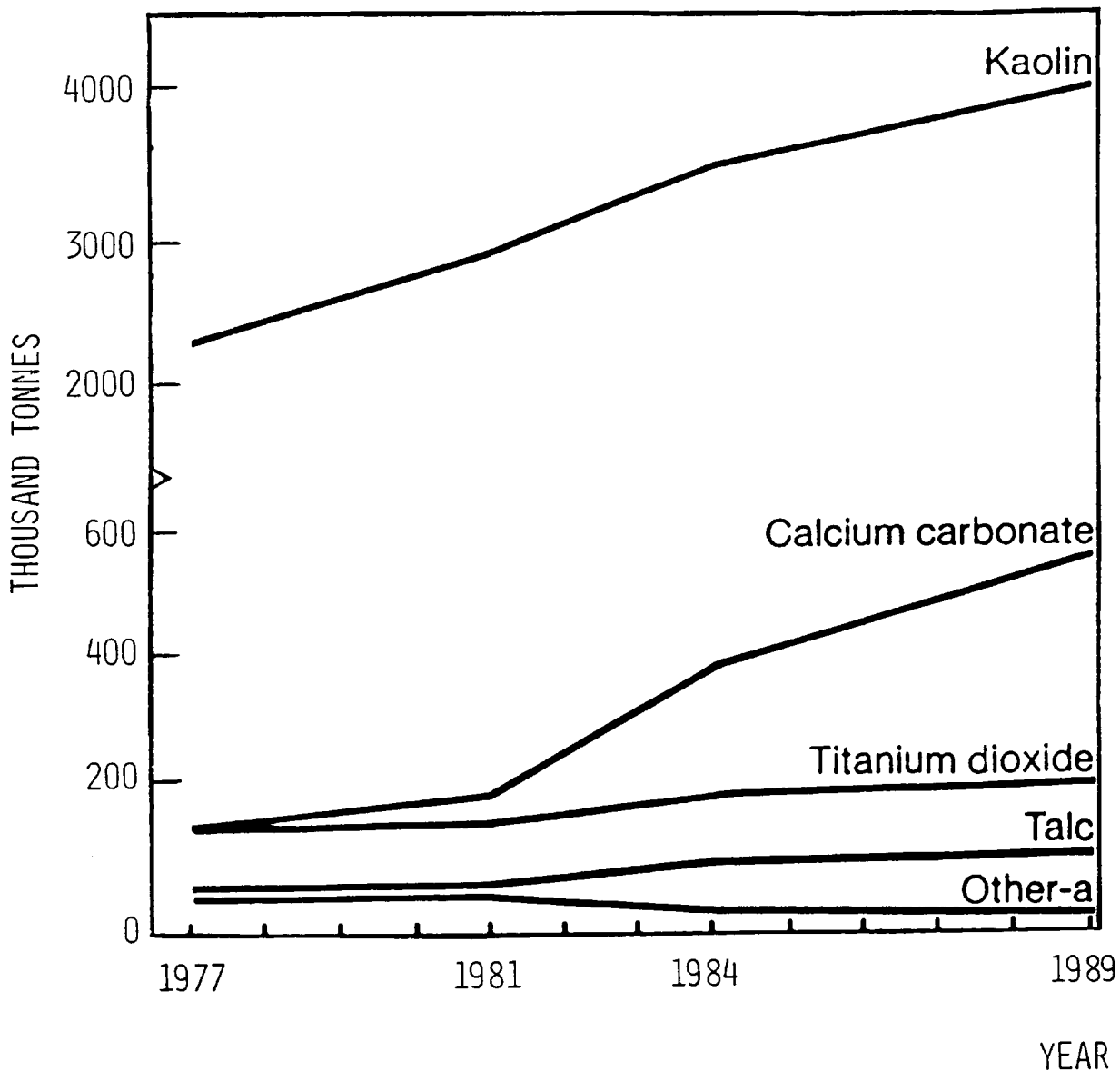


FIGURE 2-5 NORTH AMERICAN CONSUMPTION TRENDS IN MINERAL PIGMENTS, 1977-1989.

3 TALC

3.1 TECHNICAL BACKGROUND

In mineralogy, the term "talc" refers to a specific form of very pure hydrous magnesium silicate. In industry, the term talc, per se, is commonly used to cover a wide range of minerals and mineral mixtures containing talc in varying proportions and some of which, in fact, contained little or no talc at all. The term "industrial talc" would be a better description of such minerals. Because of the various and complex geological manner by which talc deposits were formed, it is common to find a number of other minerals closely associated with talc. Such associated minerals can include tremolite, serpentine, chlorite, anthophyllite, antigorite, diopside, magnesite, dolomite, calcite and quartz.

In recent years, the discovery and development of relatively pure talc deposits and the use of beneficiation processes on less pure ore deposits have provided a source of true talc mineral for industrial use. The adaptability of talc to ultrafine grinding, the plate-like nature of the fine talc particles and the inherent softness of talc have resulted in the mineral becoming of greatly increased importance and interest to the paper industry.

Pure talc is a hydrous magnesium silicate with the theoretical molecular composition $3MgO.4SiO_2 .H_2O$, or $H_2Mg_3(SiO_3)_4$. Its basic properties, compared to those of calcium carbonate and kaolin are summarized in Table 3-1 on the following page.

TABLE 3-1

PHYSICOCHEMICAL PROPERTIES OF TALC AND OTHER PIGMENTS

MINERAL	SPEC. GRAVITY	HARDNESS MOHS	REFRACTIVE INDEX	pH	BRIGHTNESS %
Talc	2.6-3	1-1.5	1.58	8-9	70-92
Kaolin	2.5-2.8	2-2.5	1.57	4.5-7.0	70-92
Carbonate	2.7-3	3	1.56	7.8-8.5	92-94

It is clear that talc does possess the basic characteristics of a papermaking pigment (brightness, low hardness/abrasion, etc.). It should be noted, however, that the properties shown in Table 3-1 above are those of a pure talc. Abrasion increases significantly with the presence of even small amounts of impurities such as quartz. The talc used for filler uses must be of fairly high purity, containing less than 1% quartz. A characteristic of talc which is a great asset in certain paper grades is its soft, platey structure which permits high surface gloss development.

Although talc is a relatively common mineral, high purity deposits are rare. Montana and California have traditionally produced the best quality papermaking talc in North America, and the United States is the largest talc producer in the world.

3.2 CURRENT USAGE

Talc is used in different end-use markets. Listed below is a breakdown of talc use in the region by end-use markets in 1987.

APPLICATION	TOTAL
Paint	40%
Pulp & Paper	26%
Plastics	11%
Other	23%

There are three major end uses of talc in pulp and paper industry.

- Pitch control in the pulp mill (80%)
- Paper filling } (20%)
- Paper coating }

3.2.1 PITCH CONTROL IN THE PULP MILL

In contrast to Europe, pitch control is the major end use in North America. Because of its natural hydrophobic surface, talc has the ability to absorb various types of pitch released from pulpwood in the pulping process. Pitch is selectively absorbed on the planar surface of micronized talc particles in the presence of water. This method has several advantages over pitch control with chemical dispersants:

- The pitch does not end up in the white water waste stream where it may cause problems in waste water treatments, or cause a build-up in recycled process water.

- Most of the talc is retained in the pulp, which is therefore an advantage since the cost of pulp is usually higher than the cost of talc.

3.2.2 PAPER FILLING

The choice of mineral for filling paper is dictated by several facts:

- Price
- Technical performance
- Chemical compatibility with papermaking system.

Talc as a filler pigment is not used extensively in Western North America. It represents less than 5% of all filler minerals used. The

TABLE 3-2

PRICES AND AVAILABILITY OF INORGANICS FOR COATING FILLER
US $ PER SHORT TON FOB

Product	Availability 1987	Price 1987	Year-end price increase (%)
Calcium carbonate			
Natural ground, range of grades, bag, ton	Market	98-140	0
Natural ground, range of grades, slurry, ton	Market	92-133	0
Precipitated, bag, ton	Market	225-265	0
Hydrated alumina			
Bag, ton	Market	500-700	0
Kaolin, clay, ton, bulk			
High-brightness, No. 1	Market	150-160	0-3
Delaminated	Tight-Market	90-95	0-3
No. 1 coating	Tight-Market	86-90	0-3
No. 2 coating	Market	60-67	0
No. 3 coating	Market	54-57	0
Calcined	Tight	420	3-5
Filler, water-washed	Market	59-60	0
Plastic pigment, bulk, lb	Market	0.80-1.00	0
Talc, bag, ton	Market	180-200	1-3
Titaniun dioxide			
Anatase, lb, dry	Very tight	0.78-0.81	3-5
Anatase, lb, slurry	Very tight	0.77-0.80	3-5
Rutile, lb, dry	Tight	0.75-0.78	2-4
Zinc oxide, lb	Market	0.60-0.80	0

TABLE 3-3
ASPECT RATIOS OF TALC, CLAY AND CARBONATE

	TALC	CLAY	CARBONATE
Average aspect ratio	**30**	**20**	**2**
Percent with aspect ratio >40	**30**	**15**	**0**

- High filler contents of 20%-30% talc give a very high smoothness on supercalendering, and make an outstanding rotogravure sheet.

- Its retention in filled paper sheets is greater than that of a kaolin clay of similar particle size distribution (see Figure 3-1).

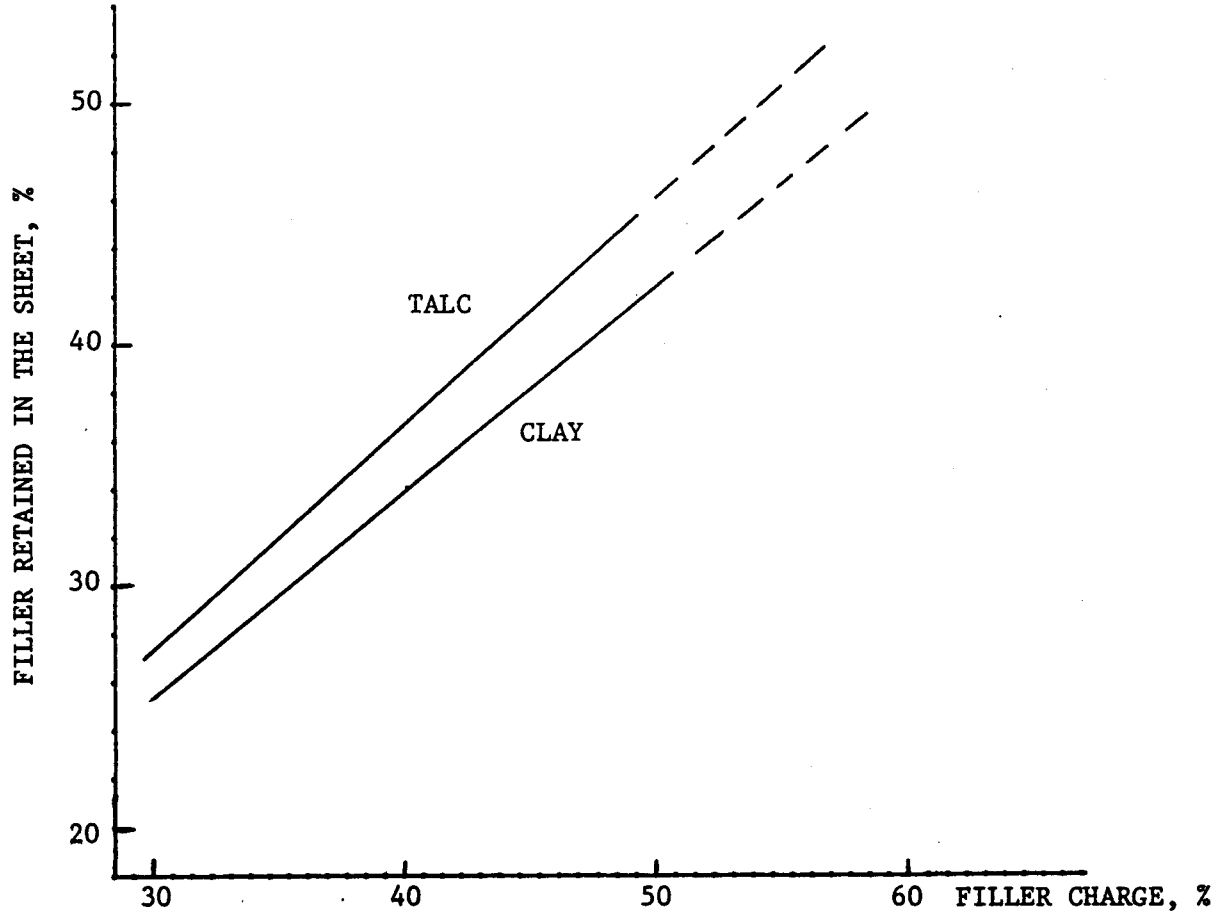
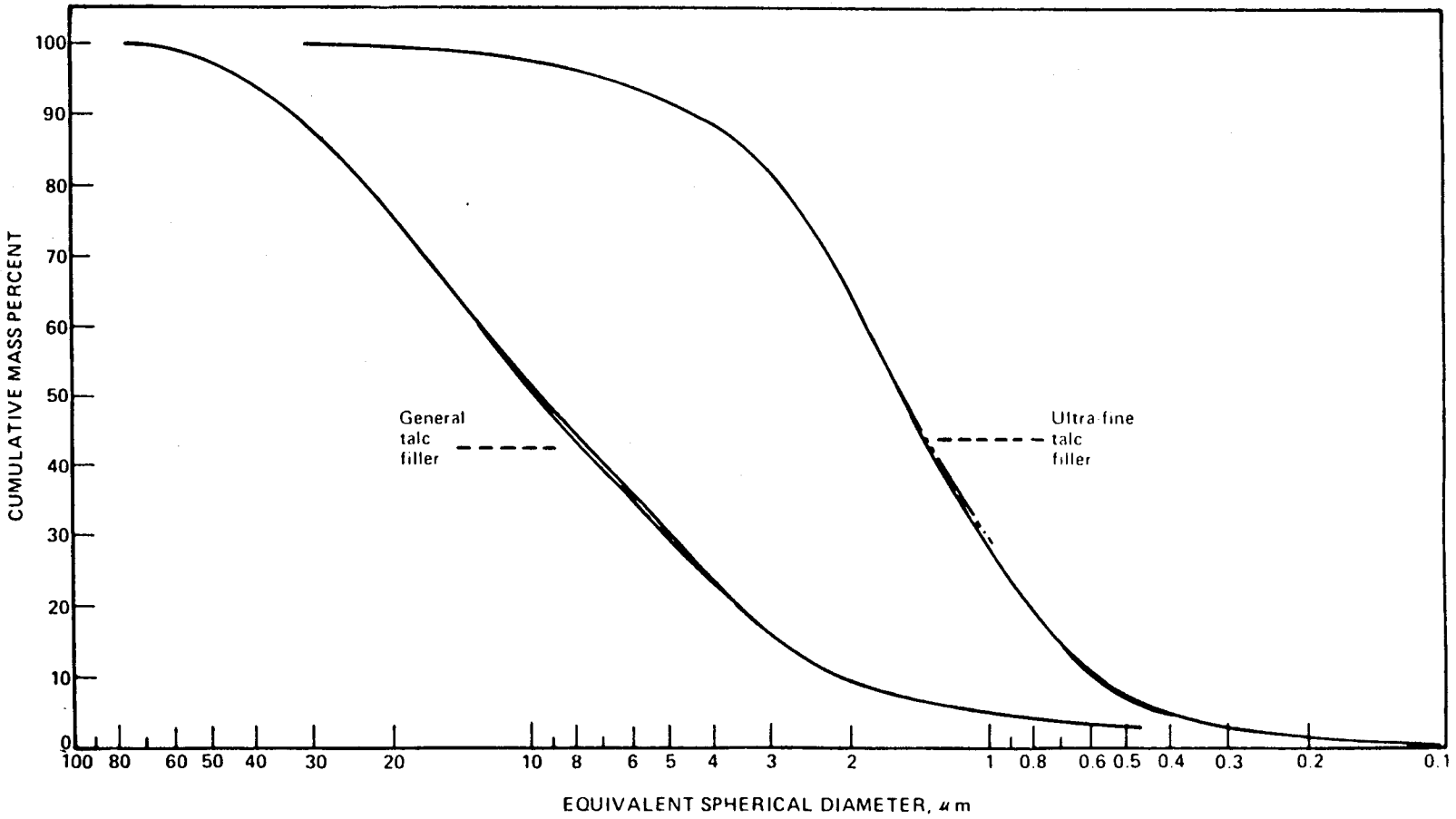


FIGURE 3-1 RETAINED FILLER AS A FUNCTION OF INITIAL FILLER CHARGE FOR EXPERIMENTAL SHEETS MADE WITH TALC AND CLAY FILLER

- Ultrafine grind talcs find specialized application in high brightness filling and as titanium dioxide extenders. Figure 3-2 illustrates the basic differences between the ultrafine grind particle size and the general filler grade.

FIGURE 3-2

PARTICLE SIZE DISTRIBUTION: GENERAL TALC FILLER AVERAGE PARTICLE SIZE - 10 M, ULTRAFINE TALC FILLER - 1.5M



3.2.3 PAPER COATING

As talc is highly hydrophobic and organophilic, it is difficult to properly disperse. Dispersion of pigment and the stability of the dispersion are vital in the pigment coating of paper. There is a marked difference between the dispersion properties of talc and other coating pigments:

- Very slow air removal from the surface (poor wetting);
- High slurry viscosity;
- Rheology of the slurry is dilatant (viscosity increase with shear rate).

Using special wetting agents and a special mixer for dispersion, it has been possible (Finland) to get these problems under control. The wetting agents moisten the hydrophobic surface of talc, and they also provide the slurry with good stability.

In choosing these wetting agents, it is important to pay attention to their compatibility with different lattices. The currently used wetting agents allow talc to be used with nearly all binder systems. Talc can also be dispersed directly into a carbonate or clay slurry without any special mixer, if the amount of talc does not exceed 30% of the pigment mixture. It should again be noted that talc can be used at both alkaline and acid pH. (Table 3-4 shows the properties of different slurries).

TABLE 3-4
PROPERTIES OF TALC SLURRIES

	100% talc	*100% carbonate*	*69% carbonate 31% talc*	*100% clay*	*70% clay 30% talc*
Solids content, %	66.5-67.0	73.0	74.9	64.9	66.4
Brookfield viscosity, mPas					
100 rpm	430-460	86	282	95	376
50 rpm	460-486	84	288	100	412
20 rpm	600-650	101	380	...	520
pH	10				
Residue on 325-mesh screen, g/kg	<0.1				

The properties of talc-coated papers are shown on Tables 3-4 and 3-5 and compared to those of clay and carbonate. The main differences between talc-coated papers (offset coated) and papers coated with clay or carbonate are:

- The density increases - talc gives a denser coated layer (high aspect ratio effect);
- Brightness and opacity are slightly reduced because of the denser packing of talc coating (the G.E. brightness of a ultrafine grind talc - pure talc - is between 90-96%);
- Smoothness is improved;
- IGT surface strength is slightly reduced;
- K&N ink absorption is reduced (not by the usage of ultrafine grind talc - see Figure 3-3).

Blended with a small amount of ground carbonate (15 parts) the paper properties range as follows:

- Carbonate opens the talc-coated layer - density decreases;
- Ink absorption increases;
- Optical properties are improved.

The comparison of the paper properties after coating for rotogravure printing shows:

- The density again increases slightly;
- Brightness is reduced;
- Heliotest printability is markedly improved.

The properties of the mixture between clay and talc are again markedly different:

- Smoothness is improved;
- Brightness, especially at low coating weights, is improved;
- Heliotest, even in the 50/50 blend, is markedly improved.

In conclusion, there are many quality benefits of talc usage in coated paper manufacture.

TABLE 3-5

COATING PROPERTIES OF DIFFERENT PIGMENTS IN OFFSET COATING AT 12 G/M^2

	Talc 100 parts 48%<2μm	*Clay 100 parts 80%<2μm*	*$CaCO_3$ 100 parts 90%<2μm*	*Talc/ $CaCO_3$ 85/15*
Density, kg/m^3	1021	949	991	989
Brightness, %	74.8	76.0	78.3	76.7
Opacity, %	95.9	96.4	96.2	96.4
Printsurf				
10 kp/cm^2, μm	1.09	1.28	1.40	1.09
20 kp/cm^2, μm	0.60	0.76	0.90	0.60
Bendtsen, mL/min	32	36	40	33
Fogra 4.90 mPa, %	57	48	30	55
2.45 mPa, %	35	29	18	35
Printed gloss, %	80	82	72	81
Unprinted gloss, %	62	60	52	61
IGT dry, m/s	0.75	0.92	1.00	0.82
K & N, %	13	18	26	21

TABLE 3-6

COATING PROPERTIES OF TALC AND U.S. CLAY IN ROTOGRAVURE COATING AT 10 G/M^2

Talc	100	. . .	50
U.S. clay (84% <2 μm)	. . .	100	50
Printsurf			
10 kp/cm^2, μm	1.14	1.49	1.10
20 kp/cm^2, μm	0.68	0.98	0.68
Brightness, %	71.9	73.2	73.0
Opacity, %	88.4	87.1	87.4
Unprinted gloss, %	55	55	59
Heliotest, mm	65	5	30

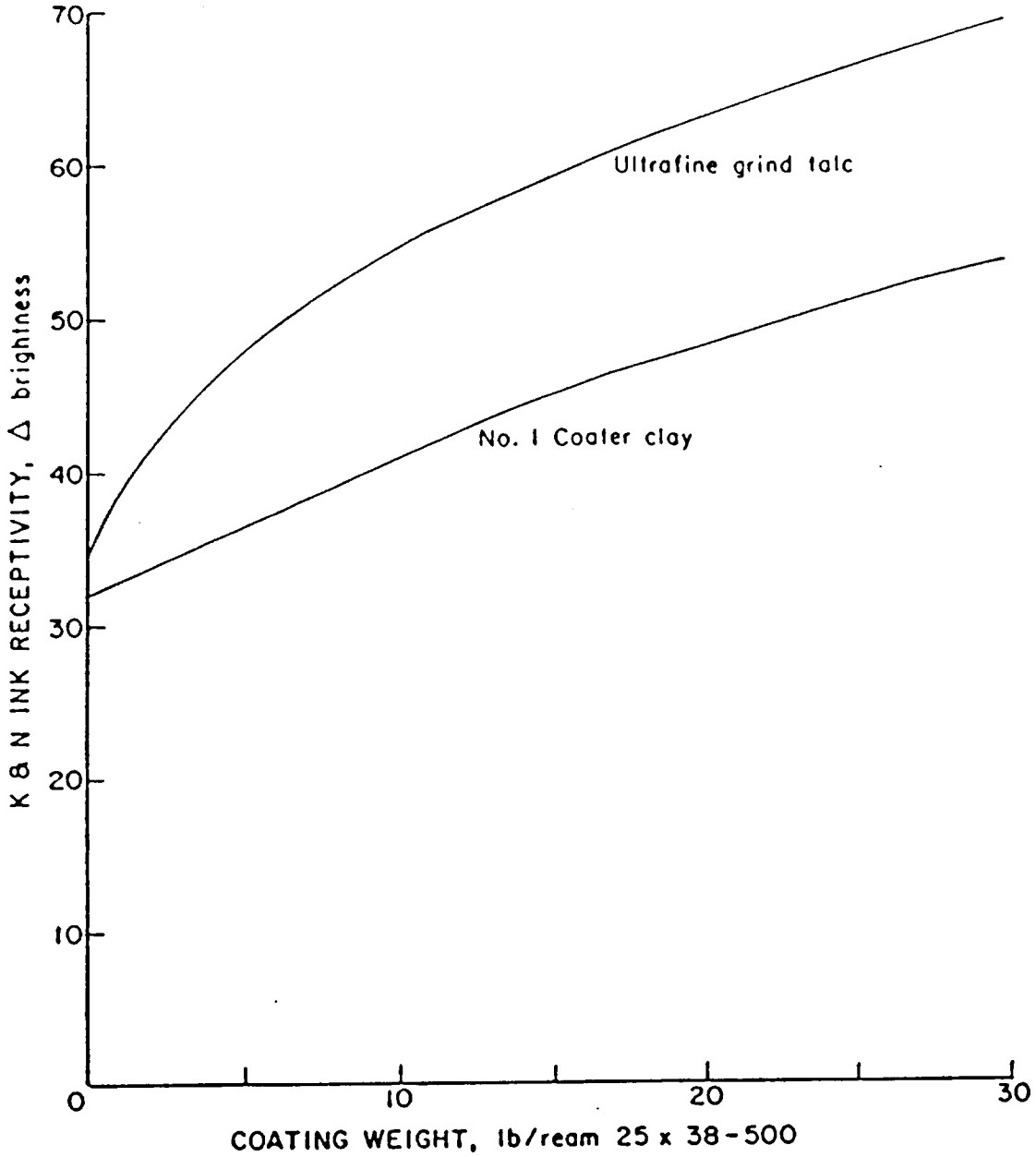
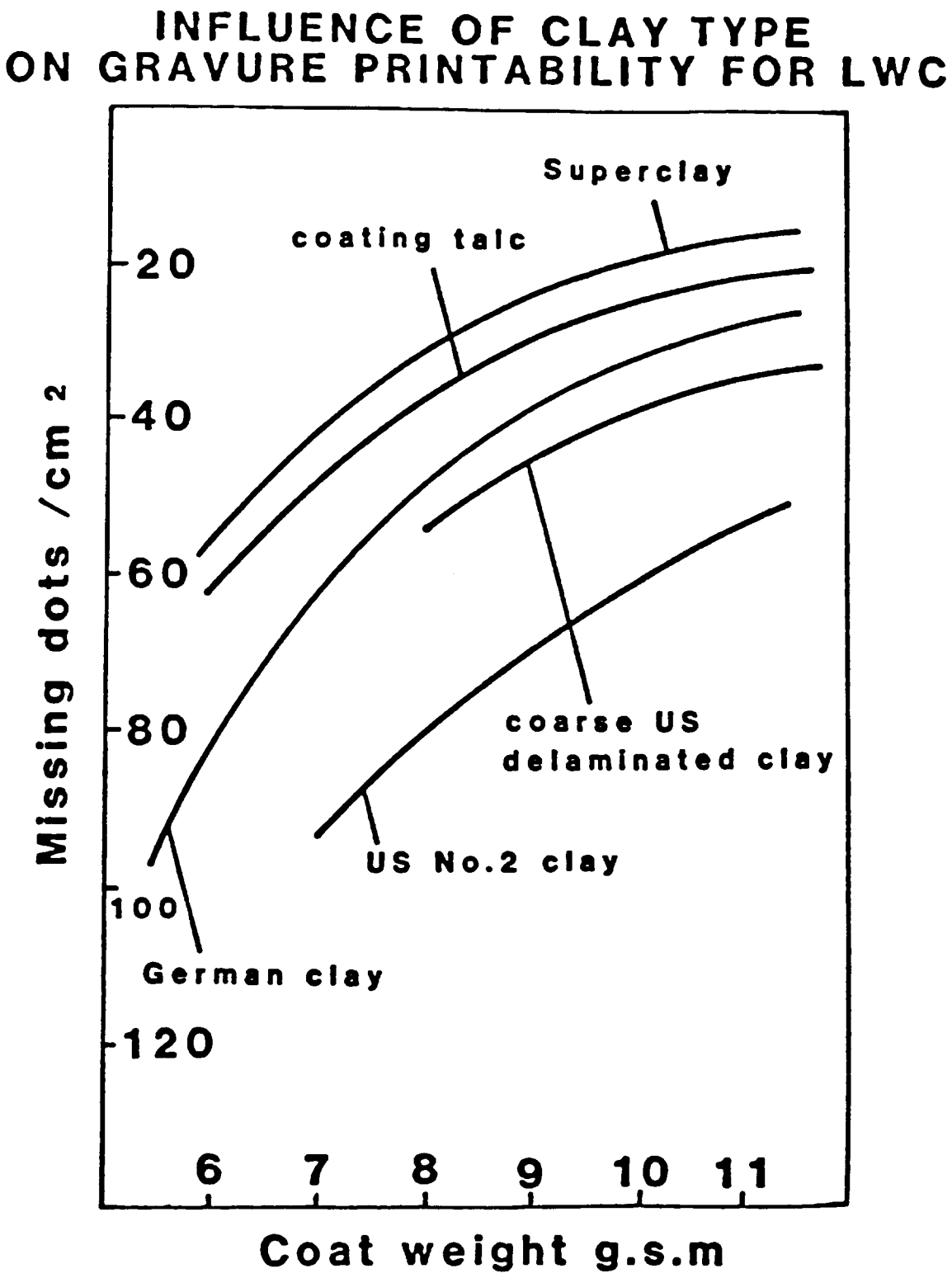


FIGURE 3-3 COMPARISON BETWEEN A 100% CLAY PIGMENT CONTENT VS. 100% ULTRAFINE GROUND TALC PIGMENT

FIGURE 3-4


INFLUENCE OF CLAY TYPE
ON GRAVURE PRINTABILITY FOR LWC
Superclay
coating talc
coarse US
delaminated clay
US No.2 clay
German clay
20
40
60
80
100
120
Missing dots /cm 2
6
7
8
9
10
11
Coat weight g.s.m

3.3 POTENTIAL

3.3.1 PITCH CONTROLLING

Since there is no other method for pitch control which gives the same excellent results (pitch, talc retention, cost), talc will continue to hold the main position.

3.3.2 PAPER FILLING

As shown above, talc has some very good properties for use as a filler. The major technical problem (its hydrophobic surface) is solvable, as the larger usage of talc as a filler in Europe shows. 80% of the talc used in Europe is used for filling and coating paper, whereas in North America, it is only 20%. One of the applications where general talc filler is especially well suited is in supercalendered, uncoated, groundwood specialties. High filler contents of 20%-30% talc give a very high smoothness on supercalendering, and make an outstanding rotogravure sheet. The ultrafine grind talcs find specialized application in high brightness filling, and as titanium dioxide extenders. The problem of dusting/linting in offset printing has inhibited further usage of talc. If it is minimized, e.g. by modifying talc surface characteristics, it would open up significant new markets.

3.3.3 PAPER COATING

The dispersion of talc for usage as a coating pigment is much different from dispersion of other pigments. However, it has been shown possible to disperse talc with solids contents comparable with those of clay pigments.

Blended with calcium carbonate or kaolin clay, talc offers the opportunity of producing excellent coated paper properties. The main problems for not being used more for coating seem to be, again, the relatively high price, and the paper industry's fear of changing an old habit.

4 POTENTIAL WESTERN NORTH AMERICAN GROWTH IN TALC USAGE FOR PAPER MANUFACTURE

4.1 GENERAL

Mineral pigments usage in paper manufacture has exhibited healthy growth in recent years. This is projected to continue, as market demand/competition are pushing paper producers towards continuously improved product quality, and demand for pigmented paper grades is growing faster than average.

We estimate Western North American demand growth for papermaking pigments to average 4-5% per year in the next few years. This could go much higher if local (Western) sources of mineral pigments are developed to supply the West Coast paper industry, as a major inhibitor of pigment by the paper industry in this region has been the high transport cost component for delivery of pigment originating in the U.S. South. This cost is of the order of US $65-75 (higher for specialty pigments) per tonne of pigment. Its restrictive influence can be readily seen by comparing West Coast newsprint, fine and coated papers tonnages relative to the rest of the continent, as seen in Table 4-1 below.

TABLE 4-1

WEST COAST VS. TOTAL NORTH AMERICAN PRODUCTION OF PRINTING PAPERS

GRADE	WEST COAST TONNAGE AS PERCENT OF TOTAL NORTH AMERICAN
Newsprint+	22-24%
Uncoated Woodfree*	10-12%
Coated*	3-4%

\+ Traditionally non-pigmented (but see below)
* Pigmented

The traditionally non-pigmented grade (newsprint) West Coast share is much higher than that of the other two, pigmented, grades.

It should also be noted, as an aside, that recent trends towards higher newsprint brightness have brought about a reduction in sheet opacity and a corresponding increase in print through. To minimize this, North American newsprint manufacturers are beginning to add mineral pigments to the newsprint, an unheard of practice for many decades. We expect this trend to accelerate, and to result in significant increases in West Coast mineral pigments consumption - e.g. if as little as 2-3% pigment is added to the 4-4.5 million tonnes of newsprint to be produced on the West Coast in the early 1990's, an increase of about 100,000 tonnes/year in pigment demand will result. This is 1/3 of total current consumption of kaolin in the region. Again, however, the high delivered cost of kaolin is forcing newsprint suppliers to look for alternative pigments. A prominent one currently is "white carbon", a synthetic silica pigment. A surface-modified talc, to minimize lint/dust tendency in offset printing, could play a major role here.

4.2 WEST COAST POTENTIAL FOR TALC IN PAPER MANUFACTUER

The current (1987) consumption of all papermaking pigments on the North American West Coast is about 450 thousand tonnes/year, of which talc's share is 4%. However, most of this talc (80%) is used in pitch control, as discussed earlier.

In order for talc to penetrate the West Coast papermaking pigments market significantly, it must first establish credibility as a suitable, value-adding pigment. Since it does possess desirable properties (brightness, softness) at least in pure form, the major obstacle, as mentioned earlier, is its hydrophobic nature which results in severe dusting during offset printing. IF THIS PROBLEM CAN BE ELIMINATED, IT IS QUITE CONCEIVABLE THAT A COMPETITIVELY

PRICED TALC COULD CAPTURE A SIGNIFICANT PORTION OF THE WEST COAST PAPERMAKING PIGMENTS MARKET.

Assuming, for the sake of argument, that the offset dusting problem is solved, it may be possible for talc to ultimately capture 15-20% of papermaking mineral pigments share in the region. When this is added to the 4-5% share for pitch control, the total potential talc tonnage goes to 20-25% of mineral pigments usage by the West Coast pulp and paper industry. Table 4-2 below sumarizes various scenarios for talc usage growth, assuming:

- The offset dusting problem is solved
- There are no talc dispersion problems
- The talc is priced 5-10% lower than other pigments of similar performance.

It should be noted that growth will be slow at the beginning, as a result of:

- The need to establish credibility with the paper industry
- Current contracts between paper mills and pigment suppliers run 1-3 years.

TABLE 4-2

WEST COAST TALC USAGE SCENARIOS IN PAPERMAKING++

	TALC CONSUMPTION, 000 tonnes/year		
YEAR	SCENARIO 1*	SCENARIO 2**	SCENARIO 3+
1987	17	17	17
1988	19	18	17
1989	25	21	19
1990	45	35	25
1991	80	65	50
1992	120	100	80
1993	150	125	100
1994	165	135	105
1995	175	140	110

*Optimistic; ** Most likely;
+ Pessimistic; ++ Based on above assumptions.

A P P E N D I X 1

BACKGROUND INFORMATION ON GEORGE IONIDES

BORN: 1945, CYPRUS.

CITIZENSHIP: CANADIAN

QUALIFICATIONS:

- B.Sc. (Hons.), ARCS, 1968, Physics, Imperial College of Science and Technology, University of London, England
- M.Sc., 1970, Physics, University of B.C., Vancouver, Canada
- Ph.D., 1972, Physics, University of B.C., Vancouver, Canada
- MBA, 1982, Simon Fraser University, Burnaby, Canada.

CAREER:

- 1972-1973: Postdoctoral Research Fellow, Institute of Space and Atmospheric Physics, University of Saskatchewan, Saskatoon, Canada
- 1973-1979: Research Physicist/Senior Research Physicist, MacMillan Bloedel Research, Vancouver, Canada
- 1979-1982: Section Head, Papermaking Research Group, MacMillan Bloedel Research, Vancouver, Canada
- 1982-present: Consultant to clients in Industry and Government; President, Temanex North Vancouver, Canada; also special lecturer/external professor in paper quality and printing at the University of B.C. (Department of Chemical Engineering in association with the Pulp & Paper Research Institute of Canada).

AREAS OF SPECIALIZATION:

- Hydrodynamics/Electrohydordynamics
- Resource management
- Economic/Feasibility/Market studies
- Manufacture of pulp and paper
- Printing/Printability
- Quality control
- Staff training

PUBLICATIONS:

- 15-20 papers on subjects ranging from instabilities of electrically charged raindrops to the marketing position of the Canadian Newsprint Industry.