Talc and Asbestos:

Talc is a powdered form of steatite, or soapstone. The image above is a typical example. It is refered to as soapstone, because of its tendency to feel slippery. This quality is often evident in the powdered form.

First the Basics

Talc has a long history of use in ceramics, having been incorporated in glazes as far back as the Tang Dynasty (618–907 A.D.). On a commercial scale, talc is used in dinnerware, paper, rubber, insecticides, roofing materials and food additives. This "silky" soft powder is basically a hydrated magnesium silicate ($3Mg0•4Si0_2•H_20$) found in metamorphic rock in layered deposits. It is formed by the pressure and heat of volcanic action on ancient sea beds. Different alteration routes can produce changes in mineralogical composition, color and crystalline structure. Trace amounts of iron, sodium, calcium and potassium can also be present depending on the geologic formation, which can result in not all talcs being interchangeable in a clay body or in a glaze formula.

The Controversy

Last year the Connecticut Department of Public Health and Education advised schools in the state to stop using art clays that might contain talc having asbestos-like minerals. That directive was apparently aimed at a talc mined in the state of New York and sold by R.T. Vanderbilt Company, Inc. under the trade name NYTAL®

TALC IN CLAY BODIES

In low temperature clay bodies (Cone 06–04), in conjunction with silica, talc causes a melting action, enabling the clay body to shrink and become dense and stronger in the firing. The glaze is then brought under slight compression and the resulting stable clay/glaze fit prevents crazing, a fine network of lines in the glaze. Talc is also used as a major component in some Raku clay bodies, offering thermal shock resistance due to its low rate of thermal expansion. Talc at high temperatures (Cone 6–10) acts as an auxiliary flux in conjunction with primary fluxes such as feldspars, yielding a dense, vitreous clay body. It can also bleach iron in reduction fired clay bodies to a light brown/red color.

Options for Non Talc Clay Bodies

In stoneware formulas (Cone 6–10) talc can function as a fast-acting flux in conjunction with feldspars. In some instances talc can be removed with the corresponding feldspar supplying enough vitrification to the clay body. An increase of the existing feldspar to achieve the same vitrification is also possible. In salt or soda fired clay body formulas talc actually has a negative result by eliminating the gloss surface texture and traditional "orange peel' effect on the fired clay surface. Whereas talc has been used in raku clay body formulas for its ability to increase thermal shock resistance, many non-talc stoneware clay body formulas can be fired to raku temperatures.

Numerous low temperature clay body formulas (Cone 06–04) can eliminate talc by using a high percentage of low temperature, high iron content clays such as Cedar Heights Redart. In white clay body formulas small percentages of frit will increase vitrification and glaze fit. As with any raw material substitution testing is always recommended. The potter can also rely on the non talc moist clay bodies which many ceramics supply companies have developed for low, medium and high temperature moist clays.

What We Know and What We Don't

by Jeff Zamek

100 HR. This talc has been used in many clay bodies, particularly those fired at low temperatures, and also sold as a raw material for formulating into glazes.

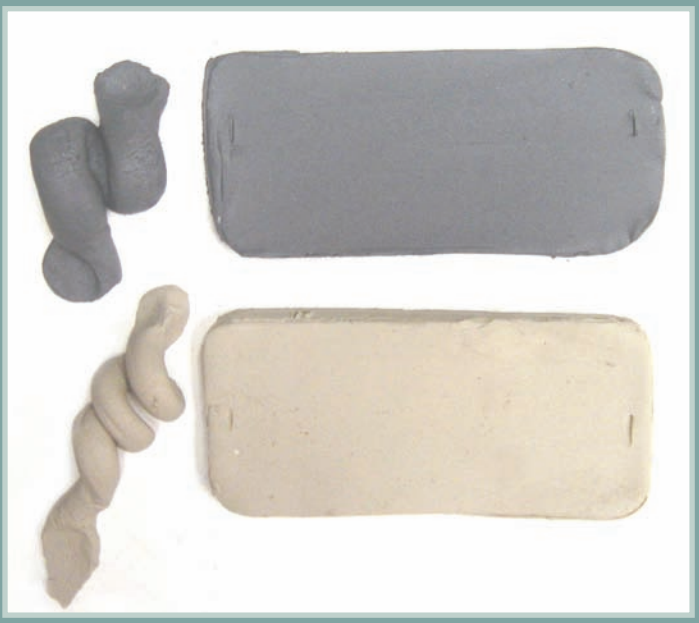
Soon after the Connecticut action, the Art and Creative Materials Institute, Incorporated (ACMI) announced it, "…has required member manufacturers using Nytal talc, if any, to reformulate their products within six months to replace such talc with suitable alternatives" (see www.acminet.org). At about the same time, the Laguna Clay Company, the largest U.S. manufacturer of packaged moist clay bodies, announced it was using only a Texas talc and no Nytal in any of its products.

As far as we can tell, there is significant disagreement regarding the toxicology and possible health risks to artists or potters using Nytal, or clays or glazes formulated from raw materials that include it. This disagreement is likely to persist for some time.

A New Jersey jury's verdict in 2006 that Nytal talc was responsible for the lung cancer death from mesothelioma (caused by asbestos) of a potter who mixed glazes using Nytal is one example. In a deposition given before he died the potter reported several different ways he could have come in contact with asbestos, such as asbestos

A COMPARISON OF TALCS

In the sidebars throughout this article are the results from our comparison of NYTAL 100 HR and Texas talc. This is just one of many talcs that can be used as a substitute, depending on the individual requirements of the potter (see "Other Talcs" on page 61). Texas talc has been used by large ceramics suppliers in low, medium and high temperature clays for many years and has an excellent performance history, which makes it an ideal choice for a substitute. Excavated stockpiles of talc are tested and certified quarterly by independent commercial laboratories for the presence of asbestos fibers. This testing has shown no asbestos fibers in this talc.



Handling Characteristics

While working with any moist clay can be a fairly subjective experience, some general impressions can be used for evaluation. The #2 Low-Fire White clay body on page 60 was used to mix both bone-dry clay samples shown to the left. The sample on top was mixed using Texas talc, and the sample on the bottom was mixed using the same percentage of NYTAL HR 100. The difference in color between the two samples is due to organic material in the Texas talc, which burned out upon firing. The fired color of both bodies can be seen on page 61.

Both samples were similar in plasticity, and dry shrinkage (5%) and Cone 06 fired shrinkage (7.5%) rates were similar for both samples. A low-fire white slip-casting clay body using Texas talc performed the same in all aspects as the same slip-casting formula using NYTAL HR 100.

Low-Fire Clay Bodies

#1 LOW FIRE WHITE
(Cone 06–04)

Texas Talc	50 %
Custer Feldspar	10
Thomas Ball Clay	40
	100 %

#2 LOW FIRE WHITE
(Cone 06–04)

Texas Talc	60 %
Wollastonite	4
Tennessee No. 1 Ball Clay	36
	100 %

This is the clay body used in the tests presented here on raw properties, handling properties and color response. Texas Talc and Nytal HR 100 were substituted on a one-to-one basis by weight.

#3 LOW FIRE RED
(Cone 06–04)

Texas Talc	20 %
Cedar Heights Redart	60
Hawthorne Bond Fireclay (35x)	20
	100 %

Mineral Analysis

TEXAS TALC

Talc	90 %
Predominately limestone	10 %

Source: The American Talc Company, Van Horn, Texas

NYTAL HR 100

Tremolite	40 %
Talc	30 %
Serpentine	20 %
Anthophyllite	10 %

Source: R.T. Vanderbilt Company, Inc.

TALC IN GLAZES

Talc provides a convenient source of magnesium and silica which upon cooling forms magnisum silicate crystals causing opaque matt glaze surfaces. When used in high percentages along with ceramic metallic oxides it can mute their color. For example, glazes containing cobalt are sensitive to higher levels of talc resulting in a mauve or lavender purple fired color. When used in high percentages talc is refractory and aids in developing opacity and matte surface textures.

Options for Non Talc Glazes

The following glaze materials contain either magnesium and/or silica, magnisum carbonate ($MgC0_3$), and flint ($Si0_2$). Some frits and dolomite ($CaC0_3 \cdot MgC0_3$) also contain magnesium but they are combined with other oxides so they won't work as a one for one substitution in glaze formulas. As a general rule, if a glaze contains less than 5% talc, the talc can be removed with no change in the glaze color or texture. At low levels, talc functions as a secondary flux in the glaze, bringing primary fluxes such a feldspars or frits into a melt. However, when removing higher levels of talc from a glaze formula, a glaze-calculation software program is a valuable tool in supplying the accurate ratios of magnesium and silica to the reformulated glaze.

pads he cut and gave to customers, house demolition, spackling used before 1977 and cutting of transite (composed of 12% to 50% asbestos and cement and produced before the 1980s) boards.

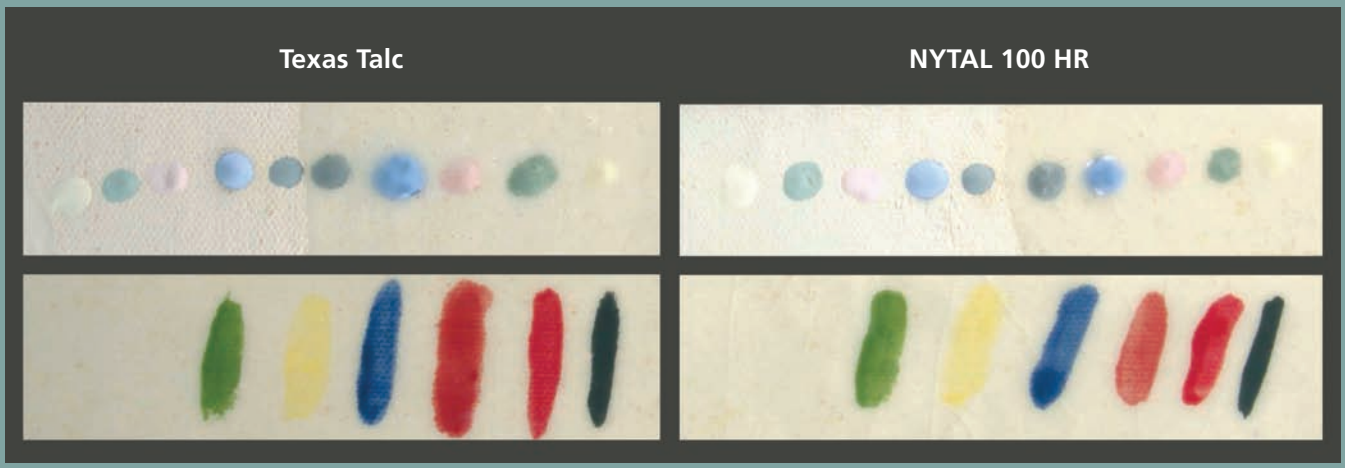
Briefly, R.T. Vanderbilt argues that while its talc contains some fibers which resemble asbestos in form, the chemical composition of the fibers is such that, "…they do not have any of the toxicological properties of asbestos." The company cites Dr. Brian Boehlecke, director of the University Employee Health Clinic at the University of North Carolina, who reviewed the pulmonary status of Vanderbilt talc workers. Dr. Boehlecke wrote, "The medical surveillance results at this time (to Jan. 2001) continue to support the conclusion submitted to the OSHA docket in 1990, i.e., the data do not indicate that the workers exposed to talc at this facility are at risk for developing asbestos related pneumoconiosis." More information is available at http://www.rtvanderbilt.com/nytalc.htm.

In conflict with Dr. Boehlecke's findings is the assessment of Dr. Woodhall Stopford, Assistant Clinical Professor, Community and Family Medicine at Duke University, and Consulting Toxicologist to ACMI. He states that Nytal talc contains fibers that are similar to those seen in asbestos, that the fibers would be expected to be durable (not break down in the lungs) and that over exposure to these asbestiform fibers would be expected to be associated with risks similar to those associated with exposures to other asbestiform fibers, including asbestos. He further noted, however, that such over exposure situations would only be expected to occur with uncontrolled exposures to Nytal talc in the powdered form and would not be expected to be seen when working with liquid slips or moist clays containing this type of talc. For more information, see http://duketox.mc.duke.edu/recenttoxissues.htm.

In announcing its requirement for ACMI members to eliminate NYTAL from their products, the institute said it was acting, "as a result of conflicting information and possible consumer confusion from reports of asbestos in ceramic clays in Connecticut schools, not from safety concerns…."

Glaze, Underglaze and Slip Response

The same clay bodies used in "Handling Characteristics" on page 59 were used for this test. For both clay bodies, colored slips were applied to the leather-hard test bars, then bisque fired to cone 010. The results were similar in color and texture in both clay bodies, and the results can be seen on the top test bars in the image below. Commercial underglaze colors and glazes were applied to bisque-fired bars and fired to Cone 06 in an electric kiln. They were identical in color response and intensity on both clay bodies. The commercial glazes applied to the bisque tiles and fired to Cone 06 matched in transparency and surface texture on both clay bodies. The underglaze and glaze results can be seen on the test bars on the bottom of the images below. Both test used identical commercial slips, underglazes and glazes.



The precise motivation for the Connecticut directive regarding talc was apparently the result of asbestos surveillance which allegedly found traces of the mineral related to school clay programs using low-fire clay bodies containing Nytal. R.T. Vanderbilt claims that one problem with this testing is that there is potential for contamination of the sample from many sources.

R.T. Vanderbilt's view is NYTAL 100 HR is harmless to people. Other reasonable and prudent people disagree. In this case, what should a ceramics artist do? Frankly, each of us is going to have to consider the facts and make our best informed decision. What we can tell you, based on the research and testing presented inthe accompanying sidebars, is that IF you choose to avoid using Nytal, or any talc—for whatever reason—acceptable substitutes are readily available. The sidebar to the right is a good place to start.

the author *Jeff Zamek is a ceramics consultant who lives in Northampton, Massachussetts. For more information, go to www.fixpots.com.*

OTHER TALCS

Commercially available talcs are mined in several locations throughout the United States. However, not all talcs are alike, due to different conditions that altered the rock from which they are formed. Depending on the talc used, it can alter verification in a clay body, modify handling characteristics and change the fired color of the clay. Listed are several talcs containing no asbestos. All but the CERAMITALC are relatively fine—88 to 92% by weight will pass through a 200 mesh screen.

Pioneer 2882 is a Texas talc that is low in calcium. 98% can pass 200 mesh.

TDM-92 is mined from the same trend of talc as Pioneer 2882.

Pioneer 4388 is a West Texas talc that fires white.

Sierralite is a refractory talc mined in Montana. It has a high alumina and low flux content.

Pioneer MB-92 is mined in Texas, and 27% is calcined at 1800° F.

Ceramitalc HDT is a coarse blended talc with high thermal expansion and low moisture expansion and is good for use in dry press operations.

Jeff Zamek will be leading a breakout session with more information on talc at the 2008 NCECA (National Council on Education for the Ceramic Arts) conference in Pittsburgh, PA. For more information on the conference, see www.nceca.net.