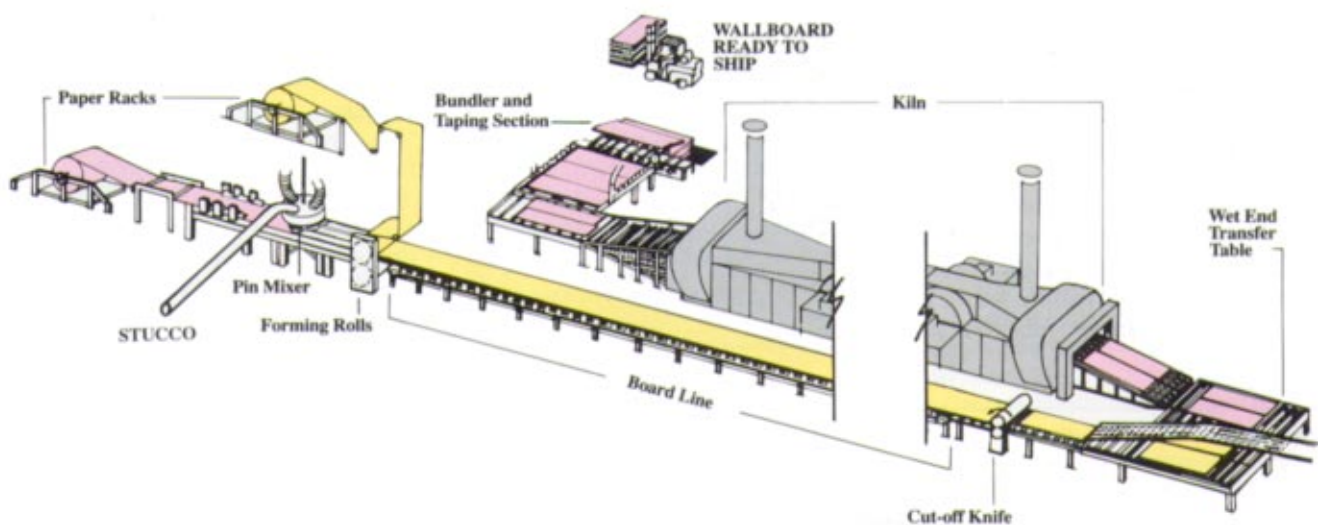


How Gypsum is Made



Editor's Note: The following article is based on information supplied by Gold Bond. It describes Gold Bond's manufacturing process. Other gypsum manufacturers may differ in certain characteristics from the process described below.

Chemists call it $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. It's found in the pyramids of Egypt as well as in toothpaste, but no one really knows where it came from or how it was formed. This rock nobody knows is gypsum, and it forms the core of one of the most important products the industry uses: gypsum wallboard.

Before gypsum can be processed and used to make a whole array of products, it first has to be removed from the ground. Gypsum is either mined or quarried at numerous loca-

tions. The oldest mine in the United States, in Medicine Lodge, Kansas, was originally opened in the 1800s by Best Brothers. Gypsum from this mine was used to make Keene's Cement, a stucco used in home construction in the 19th century. National Gypsum, of which Gold Bond is the largest division, purchased the mine in 1938.

Mines and quarries differ in both the way gypsum is extracted and the quality of the material. Quarries are large, above-ground open pit "mines." There are also underground mines that are accessed through shafts driven straight into the ground. At Medicine Lodge, the mine employs a "room and pillar" approach. Large 30' by 30' rooms are mined out with 20' by 20' pillars left between them to support the earth overhead. This method of gypsum mining produces approximately 90,000

to 160,000 tons of ore a year.

The largest gypsum quarry in the world, Gold Bond's Milford, Nova Scotia operation, produces four and a half to five million tons of ore per year. The quarry process begins by first removing the earth over the deposit. Then gypsum ore is drilled and blasted loose to be carried to the processing plant, where it is crushed and screened.

The work is demanding, yet companies in the industry maintain excellent safety records. In fact, on January 21, 1990, Gold Bond's Medicine Lodge mine and quarry operation marked its 16th year without a single lost-time accident.

Turning Rock Into Wallboard

When the gypsum reaches the plant it is stored in a huge rock pile until the plant is ready to use it. From the

rock pile, a special conveyor called a pan feeder carries the rock into a crusher. The crusher breaks up those rocks larger than two inches in diameter; smaller rocks are fed directly into the rock dryer.

The rock dryer is a huge rotating kiln or oven which evaporates any surface moisture on the rock. The dry gypsum is now ready to be ground.

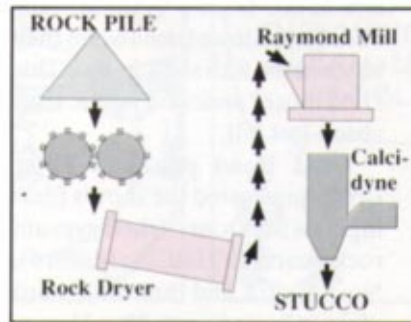
The rock is ground in a roller-type crushing mill called a Raymond mill. These powerful machines grind the gypsum into a fine powder, called "land plaster." The land plaster is then fed into Gold Bond's patented Calcidyne System, where it is "calcined," or heated to remove three-quarters of the water which is chemically combined in the gypsum itself. The result is stucco, a very dry powder that, when mixed with water, will quickly rehydrate and "set up," or harden. The stucco is fed into large bins, which then feed it into the pin mixer, the first step on the "wet end" of the manufacturing process. The stucco is blended with water and other ingredients (depending on the type of wallboard being made) to make a "slurry," or paste. This stucco slurry

will then be spread onto paper to form wallboard.

The "Bread" That Makes the Wallboard

Gypsum wallboard is frequently described as a "sandwich," with gypsum being the "meat" and paper being the "bread." Making the paper for wallboard is as complex a process as making the wallboard itself.

Gold Bond Building Products makes its own paper at three paper mills, located in Anniston, Alabama; Pryor, Oklahoma; and Milton, Pennsylvania. The raw materials used in each of these mills is waste paper from newspaper and magazine printers and old corrugated boxes from grocery chains and box manufacturers.



Each day about 815 tons of this waste paper enters their mills en route to becoming gypsum wallboard paper. The process begins when the waste paper is fed by conveyor into a pulper. The pulper is like a giant blender that dissolves the old paper into a soup, or slurry, of paper fiber called pulp. From the pulper, the slurry goes through a cleaning system where contaminants--such as bailing wire, staples, glue and ink--are removed before the pulp goes into the paper-making machines.

There are two basic ways to make

paper: using rotating cylinders and using Fourdrinier flat wire machines. Traditionally, Gold Bond has used the rotating cylinder method to make paper. However, the company recently introduced the faster, more productive Fourdrinier technology into their Pryor plant. Rotating cylinders are used at Anniston and Milton.

A cylinder machine rotates a large drum through a vat of pulp slurry. A wide felt belt passes over the top of the turning drum or cylinder. The cylinder pulls the pulp up and presses

Gold Bond Stars on "This Old House"

Millions of PBS viewers learned how Gold Bond's gypsum wallboard is made and used when they watched the fifth show in the "This Old House" series on public television last fall.

Gold Bond president Peter Browning hosted the show's filming crew for a tour of their gypsum rock quarry in Halifax (Milford), Nova Scotia, and their wallboard plant in Portsmouth, New Hampshire. The show also featured the installation of Gold Bond wallboard in the restoration of an abandoned three-story house in Massachusetts.

Each week, the star of "This Old House," Steve Thomas, demonstrates every stage of home building and renovation as it occurs on real projects. Each show includes a segment on the manufacturer of a product used in the work.

Gold Bond products have been used on the program's projects several times, but this was the first time the company and its people were featured on the show.

"This Old House" crews filmed the mining and loading processes at Gold Bond's Halifax quarry, where more than 3.5 million tons of gypsum rock are mined each year--over 240,000 tons of it destined for Portsmouth. At their wallboard plant in Portsmouth, television crews filmed the rock's movement through every step of the manufacturing process.

"The employees at Halifax and Portsmouth did an exceptional job in preparing for the show," Peter Browning said. "They represented the company well."

Over nine million faithful viewers have made "This Old House" the most popular program on public television. In fact, this Emmy Award-winning show is broadcast 591 times every week on 321 PBS stations across the country.



Gold Bond President Peter Browning shows "This Old House" star Steve Thomas backing for wallboard sheets.

it against the bottom of the felt, where it sticks to form a single ply of paper. It takes nine cylinder-made plies pressed together to make a single continuous sheet of wallboard paper.

The characteristics of the pulp entering the vats determine whether the system produces cream stock, used for the face of the wallboard, or gray stock, which makes the back side.

The Fourdrinier method uses two machines instead of nine to make a two-ply paper with the same performance characteristics as nine-ply, cylinder made paper. The pulp slurry is systematically fed onto a continuously running wire screen (the Fourdrinier). As the screen moves forward, water drains from the pulp to create the paper. One Fourdrinier machine makes the surface (top) ply, which may be cream or gray stock depending on the pulp mixture. The second machine produces the gray (bottom) ply.

From this point, both systems operate in the same way. In the press section, the paper plies are pressed together to squeeze out the excess water. Next they enter a series of high temperature dryers where any remaining water is removed. The "bone dry" paper enters what is called a "calendar stack," where different chemicals or water treatments are applied to the top and bottom surfaces to create the specific finishes required. For example, a dye and sizing agent will be added to the top surface to produce the moisture-resistant characteristics of Gold Bond's MR board.

The Fourdrinier technology improves productivity and quality by giving the mill more control over the paper formation. This assures more consistent quality. By creating only two heavyduty plies, the system reduces the weight of the paper from 53 lbs. per 1000 sq. ft. to 43 lbs. per 1000 sq. ft. Lowering the weight of the paper without reducing its performance saves freight costs, raw materials and energy.

The Final Step: Finished Wallboard

The paper is placed on racks beside the pin mixer, where the stucco slurry has been mixed with water. The

racks run above and below the exit of the pin mixer, so that the stucco slurry can be sandwiched between the paper.

The stucco slurry is then spread on a moving stream of cream-colored face paper and covered, or sandwiched, with the top paper, or "gray back," to be formed into wallboard at the master roll.

The long continuous sheet of wallboard now travels 600 to 800 feet on moving belts and roller conveyors to the knife, where it is cut into specified lengths. The long "board line" is needed to allow the gypsum slurry time (about four minutes) to harden before it is cut. The cut wallboard panels are turned cream side up and sent into the kiln to dry.

Once it leaves the kiln at the "dry end" of the process, the wallboard is sent to a bundler where it is trimmed to exact length, taped in two-panel bundles, stacked and moved to the warehouse to await shipment to end users.