

# STONE, DIMENSION

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Dimension stone can be defined as natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape (Barton, 1968, p. 4). Color, grain texture and pattern, and surface finish of the stone are also normal requirements. Durability (essentially based on mineral composition and hardness and past performance), strength, and the ability of the stone to take a polish are other important selection criteria.

Although various igneous, metamorphic, and sedimentary rocks are used as dimension stone, the principal rock types are granite, limestone, marble, sandstone, and slate. Other varieties of dimension stone that are normally considered to be special minor types include alabaster (massive gypsum), soapstone (massive talc), and various products fashioned from natural stone.

U.S. production of dimension stone in 2000 was estimated to be 1.25 million metric tons (Mt) valued at \$235 million—a 7% decrease in value compared with that of 1999. U.S. production of dimension stone in 2000 was the largest amount reported since 1993 and exceeded the 1999 amount by about 2,000 metric tons (t). Exports increased by 9.7% in value to \$59.8 million, and imports for consumption increased by 14% in value to \$925 million. Apparent consumption was estimated to be \$1.1 billion.

In recent years, most dimension stone has been used in construction applications, with the largest portions being sold or used as rough block for building and construction, flagstone, curbing, and ashlar and partially squared pieces. Monumental stone, another major type, includes memorials of various kinds.

Dimension stone production data for the United States are derived by the U.S. Geological Survey (USGS) from a voluntary survey of U.S. quarry producers of rough and dressed dimension stone. Data in this report cover rough crude quarried stone, irregular-shaped and rectangular blocks, and more highly

processed stone. A number of other terms also are used to describe further processing, such as “worked,” “dressed,” “finished,” and “manufactured.” These and other terms used by the dimension stone industry describe such features as the mineral composition of the rock, the shape of the product, the method of finishing a stone, and the type of finish applied (Stone World, 2000, p. 147-177). No adjustments are made in the data to account for the sometimes substantial losses in processing rough stone into dressed stone. Sold or used data are considered to be equivalent to production because changes in stocks are not surveyed. Of the 228 producing dimension stone operations included in the survey for 2000, 107 (or 47%) responded, which represented 58% of the tonnage; the remaining tonnage was estimated (table 1).

## Description and Terminology

There are overlaps between scientific and commercial descriptions of various dimension stone types. The scientific description of dimension stone types is focused primarily on the stone’s locality and mineralogical composition, whereas the commercial description is focused primarily on the locality and color of the stone. Furthermore, various combinations of the scientific and commercial descriptions are used by stone producers to effectively market their stone products. The descriptions that follow were adapted from Barton (1968, p. 2-8) and Currier (1960, p. 1-10).

**Granite.**—Commercial granites include all feldspathic crystalline rocks of mainly interlocking texture and with individual mineral grains that are visible to the naked eye. This category includes rock types such as gneiss, syenite, monzonite, granodiorite, anorthosite, and all other intermediate rock types. Primary colors of granites are white, gray, pink, and red, with green and brown being secondary colors. Black granites (which

## Dimension Stone in the 20th Century

Punctuated by labor strikes and high costs and wages, production of all types of dimension stone in the United States in 1900 amounted to 1.6 million metric tons. The top producing State, by value, was Pennsylvania. In the early 20th century, reinforced concrete and structural steel superseded dimension stone as major structural components in buildings. As early as 1906, granite quarriers in the United States expressed concern over the encroachment of substitute materials, such as concrete, on their industry. With the emergence of the automobile, concrete and asphalt were viewed as more suitable materials than dimension stone for road building. In 1931, when the Empire State Building was officially opened, it featured cladding of Indiana limestone and helped in creating a new market for dimension stone as interior and exterior paneling. That same year, U.S. production of dimension stone rose to the highest level of the

20th century—more than 6 million tons. The lowest U.S. production of dimension stone of the 20th century occurred in 1944 during World War II at 649,000 metric tons, owing to a lack of skilled labor, nonessential commodity status, and building construction being at a virtual standstill.

In 2000, production of dimension stone in the United States amounted to about 1.3 million tons. The top producing State, by value, was Indiana. The United States was a significant importer of stone, importing dimension stone valued at more than \$1 billion in 2000. Dimension stone was used extensively in home improvements, historic preservation, exterior and interior paneling for buildings, and construction applications. Most dimension stone was sold or used as rough blocks for building and construction, flagstone, curbing, ashlar and partially squared pieces, and monumental and memorial stones.

are not true granites mineralogically but rather such mafic rocks as diabases, diorites, gabbros, and similar rocks) are also included in this category and range in color from dark gray to black.

**Limestone.**—Commercial limestones are rocks of sedimentary origin primarily composed of calcium carbonate with or without magnesium. Included in this category are calcitic limestone, dolomite, dolomitic limestone, and travertine (a rock that is chemically precipitated from hot springs).

**Marble.**—Commercial marble includes metamorphosed limestones and serpentine rocks—all capable of taking a polish. An important member of this classification is serpentine marble, also known as verde antique, and is composed of green-to-black serpentine (a hydrous magnesium silicate mineral), crisscrossed by veins of lighter minerals such as calcite or dolomite.

**Sandstone.**—Commercial sandstone is a lithified sand composed chiefly of quartz or quartz and feldspar of fragmental (clastic) texture. Sandstone contains interstitial cementing materials, such as silica, iron oxides, calcite, or clay. Arkose (abundant feldspar grains), graywacke (abundant rock fragments), and conglomerates are included in this category. Other members of this category include bluestone (a dense, hard, fine-grained feldspathic sandstone, which splits easily along planes into thin, smooth slabs), brownstone (feldspathic sandstone of brown to reddish-brown color owing to abundant iron oxide), and flagstone (a sandstone or slate that splits into large, thin slabs).

**Slate.**—Commercial slate is a microgranular metamorphic rock formed by the recrystallization of clay sediments (shale, siltstone, or claystone). Characterized by excellent parallel cleavage, slates may be easily split into relatively thin slabs.

**Greenstone.**—Commercial greenstones are the result of the metamorphosis of basaltic rocks. Greenstone is named so because of the predominance of greenish minerals, such as chlorite, epidote, or actinolite.

**Basalt and Traprock.**—Commercial basalt and traprock includes igneous rocks that are too fine grained to be termed black granite. The name traprock is derived from the term “trappa,” meaning stairway—the characteristic terraced or steplike appearance of certain basalt lava fields. This category includes both extrusive igneous rocks (such as andesite, basalt, or dacite) and intrusive igneous rocks (such as amphibolites, diabase, diorites, fine grained gabbros, peridotites, and pyroxenites).

**Miscellaneous.**—This category includes dimension stone types that do not easily fall into the aforementioned categories, such as soapstone, talc, or steatite (rocks containing various amounts of talc). Additional miscellaneous dimension stones include diatomite, mylonites, pumice, schist, tripoli, tuff, porous or scoriaceous volcanic rocks, or any other rocks used as building stones.

## Production

Rough stone blocks split or cut from a quarry face are transported to processing plants, frequently located at the quarry site, at least for preliminary sizing. Further dressing, including final sizing and finishing operations, such as polishing, edging, and decorating, also may be done at the quarry site.

In 2000, limestone accounted for 432,000 t (or 35%) of the total domestic dimension stone production of 1.25 Mt, followed by granite (33%), sandstone (18%), miscellaneous stone (9%), marble (3%), and slate (2%). Granite accounted for about \$112 million (or 48%) of total domestic production of \$235 million,

followed by limestone (28%), sandstone (10%), slate (6%), miscellaneous (5%), and marble (3%).

Production was reported in 34 States and Puerto Rico. Leading producer States, in descending order by tonnage, were Indiana, Vermont, Wisconsin, Texas, and Georgia. These States accounted for 48% of the domestic production. The leading producer States, in descending order by value, were Indiana, Vermont, Minnesota, South Dakota, and North Carolina. These States contributed 49% of the value of domestic production (table 3).

The top five producing companies, listed alphabetically, were Buechel Stone Corp. in Wisconsin; Cold Spring Granite Co. in California, Minnesota, New York, Oklahoma, South Dakota, and Texas; Fletcher Granite Co., Inc., in Massachusetts and New Hampshire; Oolitic Victor Stone Co. in Indiana; and Rock of Ages Corp. in New Hampshire and Vermont. These companies produced about 27% of domestic production in tonnage and about 31% of production in value. The leading 14 companies accounted for 45% of total domestic tonnage and 47% of the value.

**Granite.**—Dimension granite was produced by 38 companies operating 70 quarries in 20 States. Production was 415,000 t valued at \$112 million. Granite production tonnage decreased by 5% and value decreased by 3% compared with that of 1999. The top five producing States, in descending order by tonnage, were Massachusetts, Georgia, New Hampshire, South Dakota, and Idaho. Massachusetts accounted for 17% of the tonnage of U.S. granite production. Massachusetts and Georgia combined accounted for 23% of the value of the U.S. granite production (table 4).

The leading producers were Cold Spring Granite, Fletcher Granite, and Rock of Ages accounting for over one-half of U.S. granite production in tonnage and value.

**Limestone.**—Dimension limestone was produced by 30 companies from 34 quarries in 10 States. Production decreased by 3% to 432,000 t from 446,000 t in 1999, and the value decreased by 18% to \$65.2 million from \$79.1 million in 1999. The top five producing States, in descending order by tonnage, were Indiana, Wisconsin, Texas, Minnesota, and Kansas. Indiana produced 53% of the U.S. tonnage and 49% of the value (table 5).

The leading producers were Buechel Stone; Independent Limestone Co.; Indiana Limestone Co., Inc.; Oolitic Victor Stone; and Texas Stone Quarries. These firms accounted for 59% of total U.S. tonnage and about 42% of the value.

**Sandstone.**—Dimension sandstone was produced by 28 companies operating 33 quarries in 16 States. Production increased to 229,000 t in 2000 from 197,000 t in 1999. The value decreased by 12% to \$22.9 million in 2000 from \$25.9 million in 1999. The top five producing States, in descending order by tonnage, were New York, Arizona, Ohio, California, and Michigan. New York was the leading producing State with 25% of the tonnage and 19% of the value (table 6).

The leading producers were American Sandstone, Finger Lakes Stone Co. Inc., Waller Brothers Stone Co., Jude Stone Quarry Co., and Ulti-Solutions Inc. These companies accounted for about 67% of the tonnage and 58% of the value of domestic production.

**Marble.**—Marble was mined by six companies operating eight quarries in five States. Production declined to 31,300 t valued at \$7.2 million from 38,300 t valued at \$8.6 million in 1999 (table 10). Vermont was the leading producing State, followed by Georgia, Tennessee, Colorado, and Alabama. The leading producers were Vermont Quarries Co., Georgia Marble

Co., and Tennessee Marble Co. Additional data have been withheld to avoid disclosing company proprietary information.

**Slate.**—Slate was produced by 14 companies operating 20 quarries in 5 States. Production increased slightly to 28,700 t in 2000 from 28,600 t in 1999. The value increased by 1% to \$14.2 million in 2000 from \$14 million in 1999 (table 12). The producing States, in descending order by tonnage, were Vermont, Pennsylvania, New York, North Carolina, and California. The leading producers were U.S. Quarried Slate Products Inc., McAlpine Alfred Inc., Dally Slate Co., Ritchie Bros. Slate Co., and Quarry Slate Industries Inc. Additional data have been withheld to avoid disclosing company proprietary information.

## Consumption

Rough stone represented 55% of the tonnage and 46% of the value of all dimension stone sold or used by domestic producers, including exports. The largest uses of rough stone were in construction (50%) and irregular-shaped stone (19%) applications, by tonnage. Dressed stone represented 45% by tonnage and 54% by value of the total stone sold or used. The largest uses of dressed stone, by tonnage, were in flagging (28%), ashlar and partially squared pieces (20%), and curbing (10%) (table 7).

Uses for the different varieties of dimension stone varied considerably. The major uses of granite sold or used in 2000, by tonnage, were in rough blocks for construction (24%), monumental rough stone (21%), curbing (13%), monumental dressed stone (7%), and ashlar and partial squared pieces (6%) (table 8). Primary uses of limestone, by tonnage, were in rough blocks for building and construction (45%) and irregular-shaped stone (14%) (table 9). Primary uses of marble, by tonnage, were rough blocks for building and construction (44%) and dressed slabs and blocks for building and construction (13%) (table 10). Primary uses of sandstone, by tonnage, were in dressed stone for flagging (59%) and rough blocks for building and construction (12%) (table 11). Dimension slate sold or used by producers in the United States in 2000, by tonnage, was principally for roofing (38%), flooring (37%), and flagging (8%) (table 12).

Overall, the apparent consumption of dimension stone in the United States was estimated to be \$1.1 billion in 2000, an increase of 8% compared with that of 1999. Apparent consumption is defined as production plus imports for consumption minus exports. Value data are used in the apparent consumption calculation because tonnage data are not available for imports and exports. Additionally, changes in industry stocks are not considered because the data are not available.

## Prices

The average 2000 value for dimension stone was \$188 per metric ton—a decrease of 7.8% from that of 1999, based on the USGS survey. The average unit values for different types of dimension stone were granite, \$270 per ton; limestone, \$151 per ton; sandstone, \$100 per ton; marble, \$228 per ton; and slate, \$495 per ton. Price data that are available show considerable variation. Prices are substantially different not only for the kind of stone but also for the appearance of the same kind of stone. Color, grain structure, and finish contribute significantly to price and marketability.

## Foreign Trade

**Exports.**—In 2000, total exports of dimension stone increased in value by about 9% to about \$60 million compared with those of 1999; granite accounted for 58% of the export value. The largest share of granite was exported to China (table 13).

**Imports.**—The value of imports for consumption of dimension stone types increased in 2000 by about 14% to \$925 million. Italy continued to be the major single source of granite, accounting for 42% of granite imports. Other important granite import sources included Brazil (18%), India (13%), and Canada (11%) (table 14). Italy also was a major source of rough and dressed marble, slate, and travertine imports (tables 15, 16). Duties on imported dimension stone are listed in table 2.

## World Review

World dimension stone production, excluding the United States, was estimated to be approximately 60 Mt in 1999, and preliminary numbers indicated that this total was unchanged for 2000. Although some small-scale production probably occurred in the majority of the world's nations, dimension stone was produced and officially reported in about 34 countries. The top five producing countries in 1999, in descending order by tonnage, were China, Italy, India, Iran, and Spain. These countries accounted for about 72% of the world production. The United States ranked 10th in world production of dimension stone in 1999 (Internazionale Marmi e Macchine Carrara S.p.A., [2001], International quarry production, accessed August 27, 2001, at URL <http://www.immcarrara.com/stat/english-version/index-stone-sector.html>).

## Outlook

The U.S. dimension stone industry has experienced renewed growth in the past 2 to 3 years, but the economic slowdown in late 2000 and early 2001 has reduced domestic production backlogs for most stone types. However, industry experts anticipate growth in dimension stone sales during the near term because of improved technology and variety and the increased costs of alternative construction materials. Additionally, for residential and office building construction, growth in the use of dimension stone is expected in new prestige markets for home improvement, as well as in renovations to attract and keep tenants.

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## GENERAL SOURCES OF INFORMATION

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