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## The management of dimension stones in Poland in the years 2011–2021

### Introduction

Recent years have been a period of fluctuation in the dimension stone market in Poland related to changes in the volume, assortment structure and directions of imports and exports, coupled with variability of the volume of extraction from domestic deposits (Galos and Lewicka eds. 2021). As recently as the early 1990s, the most commonly used stone materials in Poland included granites from domestic suppliers in the Strzegom, Sobótka and Strzelin regions, syenites from the area of Piława Górna, marbles from Stronie Śląskie and Sławnowice, decorative limestones from the Świętokrzyskie area, and sandstones from Lower Silesia, the Szydlowiec region and the Carpathian Mountains (Guzik and Smakowski 2015). The opening of the domestic market to imported raw materials has led to an increase in the share

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of foreign suppliers in the segment of both crude and worked dimension stones, as well as in the segment of pitcher, curbs, and other road stones. A significant growth in the demand for various types of stone materials was associated with the development of the domestic construction sector and new road investments (including the revitalization of old town centers). Increasing consumption of dimension stones in Poland was enhanced by the availability on the market of numerous stone varieties ranging in terms of utility values and visual characteristics (originating from domestic mines or imported). However, the coronavirus pandemic and then the war in Ukraine have caused disruptions in the supply chains of many mineral resources (Lewicka et al. 2022). This also applies to some varieties of dimension stones imported to Poland. A significant growth of transport costs that have been registered particularly from Asian producers resulted in the changes in supply directions in recent years.

In Poland, deposits of rocks suitable for the production of crushed and dimension stone are recognized in one common group. In this category, 746 deposits with total reserves of 11,615.4 million tons were documented in 2021 (BZZK 2022). The domestic resource base of this group is mainly utilized for the production of mineral crushed aggregates, the volume of which fluctuated in the range of 57.9–88.7 million tons/year in 2011–2021. Dimension stone extraction has been limited to deposits of selected rock varieties, including granite and sandstone, and to a lesser extent syenite, limestone, marble and dolomite. Despite the suitability for the production of blocks, carbonate conglomerates documented in two deposits in the Świętokrzyskie region remained unexploited. The total volume of the extraction of blocks and smaller dimension stones in Poland in 2011–2019 did not generally exceed 1.5 million tons/year with the growth to 1.7 million tons/year in 2020–2021. The assortment structure of the output is dominated by granites, with their share being ca. 92% in 2021, while sandstones accounted for ca. 7% and other rock varieties together for ca. 1%.

## 1. Methodology

The analysis of dimension stone management in Poland in 2011–2021 included different varieties of rocks extracted from domestic sources as well as rocks originating from imports. The volume of dimension stone output from domestic deposits have been estimated on the basis of data from producers or evaluated using information on the quantity of blocks (whenever they are available) and the volume of output from individual deposits (reported in ‘The balance of mineral resources deposits in Poland’ as of 31.12.2021; BZZK 2022 and earlier editions). The conducted analyses included dimension stones in the form of regular blocks as well as various types of other stone elements differing in terms of shape and size (e.g. lumps, ashlar blocks and split tiles). The former are used in the production of vertical and horizontal cladding slabs and gravestones, as well as various types of processed elements, including fireplaces, window sills, stair treads, pitcher and curbs. In turn, split tiles (usually obtained from thin bedded sandstones) are used primarily in garden architecture and in constructions as stone for building façades.

Data on the dimension stone trade have been reported by Statistics Poland (GUS) for the following groups of products imported and exported to Poland:

- ◆ crude and roughly worked blocks and slabs;
- ◆ worked dimension stone;
- ◆ pitcher and other road stones (e.g., curbs, paving slabs).

Within the first two groups, data is presented separately for:

- ◆ marbles and other carbonate rocks;
- ◆ granites;
- ◆ other rocks;
- ◆ sandstones (exclusively in the group of crude and roughly worked blocks and slabs).

This division does not strictly correspond to the petrographic characteristics and classification of rocks and is primarily related to their technological properties. In accordance with this, the group of rocks referred to as granites includes different varieties of rocks, such as igneous rocks (e.g. granites, granodiorites, diorites, syenites, norites), and subordinately also metamorphic rocks (e.g. gneisses), which are suitable for permanent polishing. In turn, the category of marbles and other carbonate rocks sometimes includes quite genetically different rocks, such as serpentinites and quartzites. Although not specified in detail, the group of other rocks probably includes shales, as well as varieties of volcanic rocks (porphyry, basalt). In the case of worked dimension stones, it also includes sandstones, which are not separated as an individual category.

## 2. Results

### 2.1. Domestic mining output of rocks suitable for dimension stone production

The extraction of rocks suitable for the production of dimension stones in Poland is concentrated primarily in Lower Silesia, where deposits of granite, sandstone and subordinately syenite as well as marble have been exploited. The most important area of **granite** extraction is the Strzegom–Sobótka massif (the so-called “Strzegom plate”; [Blachowski and Buczyńska 2020](#); [Glapa and Sroga 2013a, 2013b](#); [Karwacki 1988](#); [Stryszewski ed. 2012](#)), and only to a limited extent the Strzelin and Karkonosze massifs ([Guzik 2009](#)). In 2021, dimension stones (both blocks and smaller elements) were mined from more than twenty granite deposits, at a total volume of about 1.6 million tons/year (an increase from 1.2–1.5 million tons/year in several previous years; Table 1). The highest output level, above even 100 thousand tons/year, was reached from the Borów, Borów 17, Grabina Śląska kam. 15/27, Strzegom kam. 25/26, Kostrza-Piekiełko, and Żółkiewka IV deposit. The most important companies involved in the extraction of granite blocks and smaller dimension stones in 2021 included, for example, Borowskie Kopalnie Granitu i Piaskowca – Skalimex sp. z o.o, sp. j., Grabinex sp. z o.o., Skalimex-Borów SA, GT&F Corporation Polska sp. z o.o., Granit Strzegom SA, PPHU Piramida SA, and Globgranit Strzegom sp. z o.o.

Table 1. The estimated volume of mining output of rocks suitable for the dimension stone production<sup>1</sup> in Poland in the years 2011–2021 (thousands of tons/year)

Tabela 1. Szacunkowa wielkość wydobycia skał przydatnych jako kamień bloczny w Polsce w latach 2011–2021 (mln ton/rok)

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Granite	1,240	1,190	930	1,230	1,270	1,260	1,160	1,240	1,190	1,490	1,640
Sandstone	260	220	220	260	180	190	220	170	150	220	120
Other rocks	20	20	30	20	20	20	20	30	30	10	20
Total	1,520	1,430	1,180	1,510	1,470	1,470	1,400	1,440	1,370	1,720	1,780

<sup>1</sup> Both blocks and smaller dimension stones.

Source: [BZZK 2021](#) (and previous editions), authors' estimations.

**Sandstones** are the second important group of rocks utilized in the form of blocks and smaller dimension stones. In 2021, the total volume of their output was at the level of ca. 120 thousand tons/year. This was a decrease in relation to the volume obtained in 2011–2020, which was in the range of 150–260 thousand tons/year (Table 1). Extracted sandstones, belonging to different stratigraphic levels (from the Permian to the Neogene), show considerable variability in terms of lithological features, such as color, grain size, bed thickness, and the type of sedimentary structures. As a result, they strongly differ in terms of their physical and mechanical properties as well as the sizes and quantities of blocks suitable for the extraction ([Figarska-Warchoł and Stańczak 2016](#); [Guzik 2013, 2017](#); [Peszat 1973](#); [Pinińska 1994](#); [Rembiś 2010](#); [Urban 2016](#)). In 2021, sandstones for the production of blocks and smaller stone elements were sourced from more than forty deposits in Poland. The highest level of mining output has been registered by, for example, Drebol sp. z o.o., Kamieniarz sp. z o.o., Piasmar sp. j., Gruszecki s.c., Borowskie Kopalnie Granitu i Piaskowca Skalimex sp. z o.o., and Kamieniołom Barwałd sp. z o.o. with the Brenna Głębiec.

In **Lower Silesia**, sandstones have been extracted in the region of the Intra-Sudetic Synclinorium (Permian and Cretaceous sandstones) and the North Sudetic Synclinorium (Cretaceous sandstones). In 2021, blocks and other dimension stones were obtained from ten deposits with the total amount reaching ca. 65,000 tons. The most valuable sandstone varieties extracted in this area are yellow and white Cretaceous sandstones, which have been used in construction for many centuries ([Głapa and Sroga 2011](#); [Guzik and Kot-Niewiadomska 2015](#)). The most important deposits of these rocks, with production volumes not exceeding several thousand tons/year in recent years, are Wartowice V, Wartowice, Radków, Szczytna-Zamek, Żeliszów, Zbylutów-IV Jan and Długopole.

Outside of Lower Silesia, sandstones are also extracted in the **northern margin of the Świętokrzyskie Mountains** and in the Carpathians. In the Świętokrzyskie area, twenty-seven

deposits located within the administrative boundaries of three provinces (Łódź, Mazowieckie and Świętokrzyskie Provinces) were exploited in 2021. The volume of extraction of rocks suitable for the production of blocks and smaller dimension elements in the analyzed region has been most recently significantly lowered. In 2021, it amounted to ca. 24,000 tons/year while in the previous years, it was in the range 40–60 thousand tons/year. The most important variety of rocks in this area are sandstones of Jurassic age, with deposits recognized and exploited in all three provinces. These are highly vulnerable for dressing sandstones of white and yellow color (less frequently with intercalations of pink sandstones, in which lamination is emphasized by the occurrence of hematite; Bromowicz and Figarska-Warchoł 2011a, 2012; Gągoł 1996; Guzik 2017). The extraction of these rocks is concentrated in the area of Szydłowiec (Mazowieckie Province) and Żarnów (Łódź Province), where numerous small mines are in operation. The volume of output from individual deposits ranges from a few dozen tons/year to several thousand tons/year. Other sandstone varieties occurring in the Świętokrzyskie region are Triassic sandstones (generally red and pink in color) and Cretaceous sandstones (generally white and yellow). The former are obtained in the form of blocks and split tiles from the Tumlin-Gród, Kopulak and Parszów deposits (Świętokrzyskie Province; Bromowicz and Figarska-Warchoł 2011a, 2012; Gągoł 1996), while the latter have been extracted in extensive pits located on the southern slopes of the Chełmo Mountain (near Przedbórz in Łódzkie Province; Guzik 2013).

In the **Carpathians**, Godula sandstones, Krosno sandstones, Istebna sandstones, Magura sandstones and Cergowa sandstones are the most important sources of dimension stones. Varieties of sandstones occurring in this area are diversified in terms of their technical and decorative properties as well as their susceptibility to processing. They are mined in Śląskie, Małopolskie and Podkarpackie Provinces. The highest level of production (generally several thousand tons/year) was recorded for the following deposits: Głębiec (Godula sandstones), Górka–Mucharz, Barwałd (Krosno sandstones; there have been no dimension stone extraction from these two mines since 2022), Barcice I, Męcina, Tenczyn Lubień II (Magura sandstones). In recent years, the output of blocks and smaller stone elements from the Istebna sandstone deposits, extracted primarily in the vicinity of Wola Komborska in Podkarpackie Province, has been significantly reduced (to a few thousand tons/year).

With regard to **other varieties of rocks** suitable for the production of dimension stones, syenites from the Koźmin deposit, marbles from the Sławniowice deposit, dolomites from the Libiąż deposit and several varieties of limestone in different regions of Poland have been mined in small quantities (Table 1). The output of carbonate rocks has been significantly reduced in recent years, particularly in the Świętokrzyskie region where several deposits of decorative dimension limestones belonging to various geological units were obtained in the past. This includes the Bolechowice deposit (Devonian limestones) and the Wola Morawiecka deposit (Jurassic limestones; Bromowicz and Figarska-Warchoł 2011b; Guzik 2018) which were traditionally sources of limestones known as “Kielce marbles”. In addition, Miocene organodetritic limestone was also exploited in the past from the Pińczów deposit in the Świętokrzyskie Province. In the Dolnośląskie Province, the mining of marbles

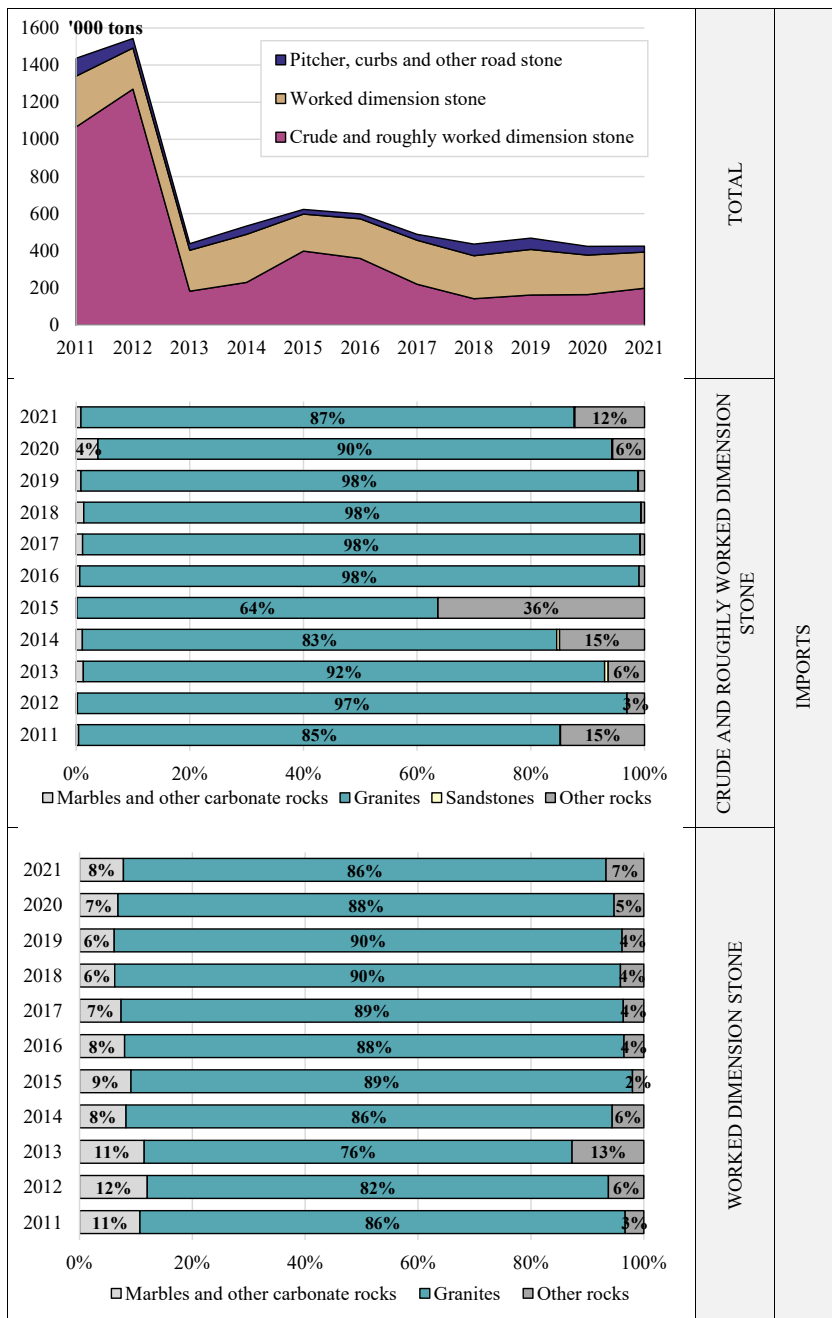


Fig. 1. The structure of the dimension stone imports to Poland in the years 2011–2021 (authors’ elaboration based on Statistics Poland data)

Rys. 1. Struktura importu kamieni blocznych do Polski w latach 2011–2021 (opracowanie autorów na podstawie danych GUS)

from the Biała and Zielona Marianna deposits was terminated in 2011. In the Małopolskie Province, the extraction of Devonian limestone from the Dębnik deposit has not been performed since 2007. Currently, small amounts of dimension stones are extracted primarily from the Morawica III-1 deposit (Jurassic Moravian limestone) by KW Morawica SA, as well as from the Gołuchów 1 deposit (Jurassic oolitic limestone) and Włochy I deposit (Tertiary organodetritic limestone) by the Marmur-Płytki Jacek Łata company. Additionally, some amounts of smaller stone elements have been obtained from limestone deposits in the Lublin region.

## 2.2. Volume and structure of dimension stone imports

The total volume of imports of various types of dimension stones to Poland ranged from 424.3 to 623.0 thousand tons/year in the years 2013–2021, and only in 2011–2012 its level was several times higher (1,436.6–1,542.9 thousand tons/year; Figure 1). The assortment structure of imports was dominated by crude and roughly worked blocks and slabs, which accounted for 74–82% of total supplies in 2011–2012 and 33–64% in 2013–2021 (Figure 1). The share of worked dimension stones increased from 14–19% in 2011–2012 to 32–53% in subsequent years (Figure 1). Imports of pitcher, curbs and other road stones was of subordinate importance (3–14%; Figure 1).

The group of **crude or roughly worked blocks and slabs**, imported at a total of 142.6–1,270.6 thousand tons/year, was dominated by granite supplies (64–98%; 139.8–1,228.0 thousand tons/year; Figure 1). Imports of sandstone (up to 1.2 thousand tons/year) as well as marble and other carbonate rocks (0.5–6.3 thousand tons/year) was marginal (Figure 1). The share of other rocks generally did not exceed 15% and only increased to 36% in 2015 (0.8–157.4 thousand tons/year; Figure 1). **Granites** were mainly imported from South Africa and India in the amounts of 60.1–76.3 thousand tons/year and 26.8–66.3 thousand tons/year, respectively (Figure 2). In the years 2011–2012, a spectacular increase in the volume of imports of these rocks from Scandinavian countries have been reported. Deliveries from Sweden increased tens or even hundreds of times in that period in comparison with the level of previous years (to 737.2–805.1 thousand tons/year), while from Norway, deliveries grew to 274.0 thousand tons/year in 2012 (Figure 2). In subsequent years, the volume of imports from these two directions was reduced (in the case of Sweden to 4.2–20.4 thousand tons/year, and in the case of Norway to a maximum of about 3.0 thousand tons/year; Figure 2). The reported short-term increase in the volume of imports was primarily related to mechanically and chemically resistant rocks, which were used for hydrotechnical construction purposes on the Baltic Sea coast (including the construction of new breakwaters in Kołobrzeg). It was recorded not only for granite but also for a group of other rocks for which deliveries from Sweden increased to about 154.0 thousand tons/year in 2011 (Figure 2). Important suppliers of crude and roughly worked granite blocks and slabs in the analyzed period also included Spain, Ukraine, Angola and Finland, with import levels not exceeding several

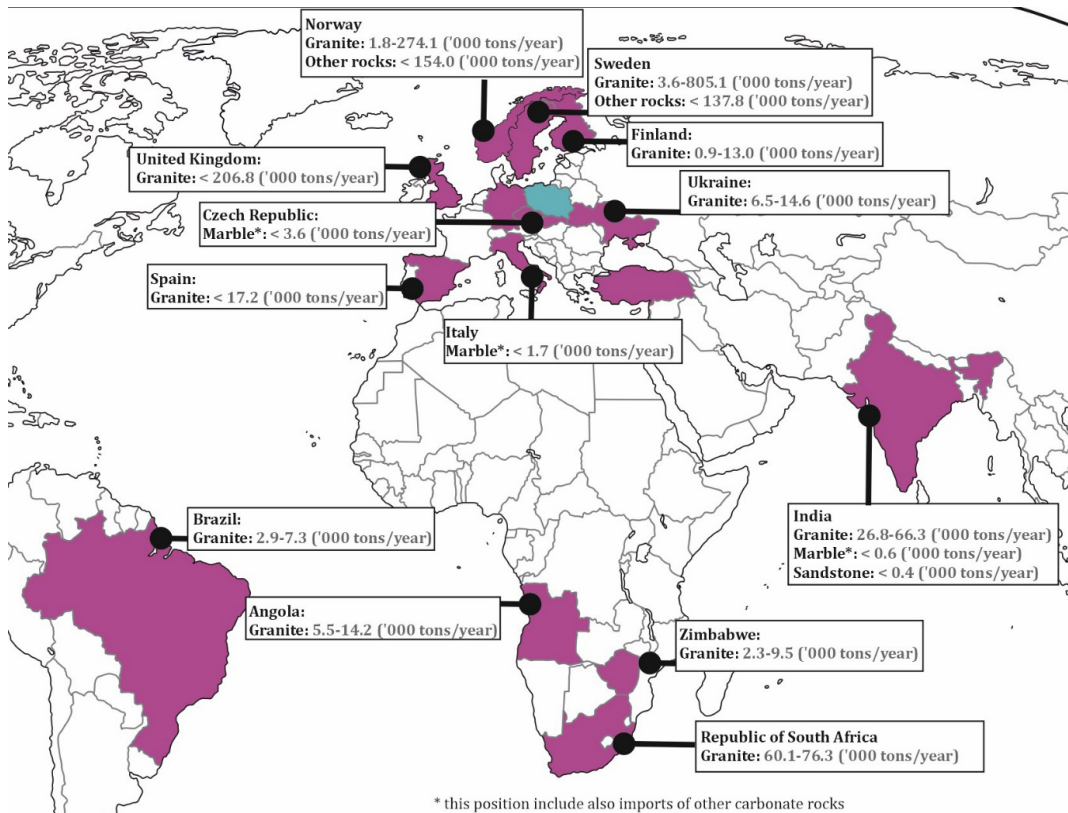


Fig. 2. The major suppliers of the crude and roughly worked dimension stones to Poland in the years 2011–2021 (authors' elaboration based on Statistics Poland data)

Rys. 2. Główni dostawcy surowych i wstępnie obrobionych kamieni blocznych do Polski w latach 2011–2021 (opracowanie autorów na podstawie danych GUS)

thousand tons/year, and additionally in 2015–2017, the United Kingdom (67.5–206.8 thousand tons/year; Figure 2). Zimbabwe and Brazil were smaller but regular suppliers of raw dimension granite (less than 10.0 thousand tons/year). **Other rocks** were imported in quantities not usually exceeding a few tons/year, primarily from Ukraine, Germany and Slovakia. Periodically larger quantities of this type of dimension stones were imported from Norway (33.2–154.0 thousand tons/year in 2011–2012) and Sweden (25.7–137.8 thousand tons/year in 2014–2015; Figure 2). In the case of **marbles and other carbonate rocks**, as well as **sandstones**, it is difficult to identify regular suppliers as their imports in the analyzed period remained at a very low level. Carbonate rocks were mostly imported from Italy, Turkey and India (also from the Czech Republic in 2020), while sandstones originated primarily from Germany and India (Figure 2). The level of supplies from individual countries did not usually exceed a thousand tons/year.



**Worked dimension stones** were imported to Poland at a total volume of 194.8–273.5 thousand tons/year (Figure 1). The structure of their imports, similarly to crude and roughly worked blocks and slabs, has been significantly dominated by granites (76–90%; 166.6–235.2 thousand tons/year; Figure 1). The remaining proportion of supplies is accounted for marbles and other carbonate rocks (6–12%; 14.5–29.3 thousand tons/year; Figure 1) and the group of other rocks (2–13%; 4.0–28.0 thousand tons/year; Figure 1). **Granites** were imported primarily from Asian countries. The most important and regular supplier of these types of dimension stones was China (100.5–168.1 thousand tons/year in 2011–2020; a decrease to 52.5 thousand tons/year in 2021) and India, where a substantial increase in import volumes has been reported in recent years (from 38.2 thousand tons/year in 2012 to 71.5 thousand tons/year in 2021; Figure 3). Portugal, Germany, Italy and South Africa were also among significant suppliers of worked granite elements (Figure 3). The level of imports from these countries generally did not exceed a few thousand tons/year. The volume of supplies of **marbles and other carbonate rocks** has been reduced from 29.3 thousand tons/year to about 15 thousand tons/year in 2011–2021. They were imported primarily from Italy, the Czech Republic and Turkey. Each of these countries recorded a significant decrease in import volume during the analyzed period. In the case of Italy, it dropped from 6.2–7.8 thousand tons/year to less than 2 thousand tons/year, the Czech Republic from about 4 thousand tons/year to about 2 thousand tons/year, and Turkey from about 4 thousand tons/year to about 2–3 thousand tons/year (Figure 3). Suppliers of small quantities of worked dimension stones included in the group of **other rocks** (usually up to a few thousand tons/year) were mainly Germany, China and Italy (Figure 3).

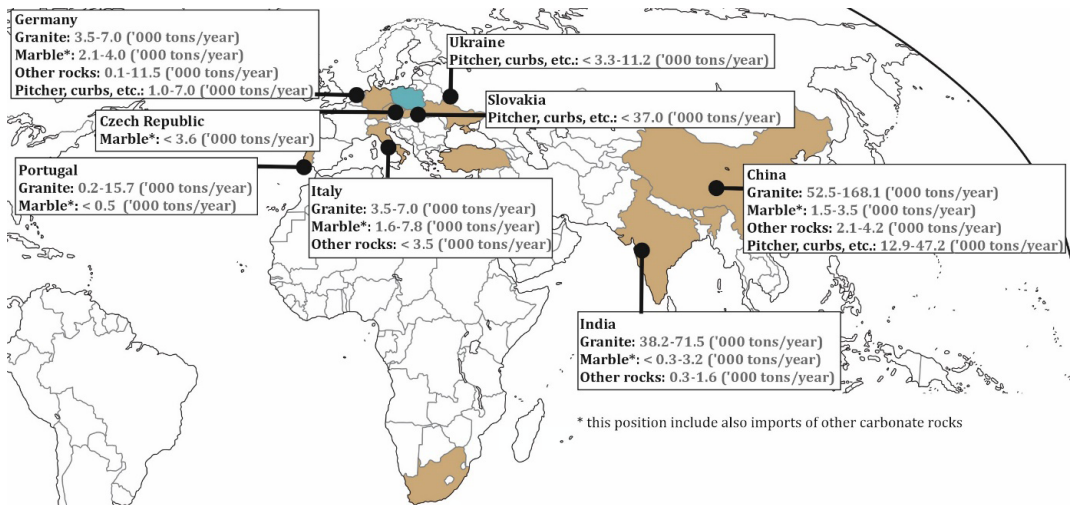


Fig. 3. The major suppliers of worked dimension stones as well as pitcher, curbs and other road stones to Poland in the years 2011–2021 (authors' elaboration based on Statistics Poland data)

Rys. 3. Główni dostawcy obrobionych kamieni blocznych oraz kostki, krawężników i innych kamieni drogowych do Polski w latach 2011–2021 (opracowanie autorów na podstawie danych GUS)

The volume of imports of **pitcher, curbs and other road stones** fluctuated over a wide range, from 25.0 to 96.1 thousand tons/year, depending on variable supplies from China (12.9–51.4 thousand tons/year), Slovakia (up to 37.0 thousand tons/year), Ukraine (3.3–11.2 thousand tons/year) and Germany (1.0–7.0 thousand tons/year; Figure 1 and 3).

### 2.3. Volume and structure of stone material exports

The total volume of stone material exports from Poland was at the level of 182.3–300.1 thousand tons/year in 2011–2021 with an increasing trend in the last four years (Figure 4). The crude and roughly worked blocks and slabs had the highest share in the total export structure (52–68%). The subject of the exports was also pitcher, curbs and other road stones (accounting for 17–35%) as well as worked dimension stones (10–19%; Figure 4).

The export volume of **crude and roughly worked blocks and slabs** increased from 99.1 thousand tons/year to 172.1 thousand tons/year between 2011 and 2021. Its structure was significantly dominated by granites (66–97%; 96.5–124.1 thousand tons/year), with a smaller share of sandstones (1–29%; 0.8–49.2 thousand tons/year), marbles and other carbonate rocks (up to 2%) and other rocks (up to 14%; 0.1–22.2 thousand tons/year; Figure 4). The major export direction of **granite** was Switzerland, where primarily significant quantities of ashlar blocks (called also wall stones) were sold (60.3–93.1 thousand tons/year; Figure 5), and Germany (21.5–41.0 thousand tons/year; Figure 5). Crude and roughly worked blocks and slabs representing **other rock varieties** were directed mainly to neighboring countries, primarily including Germany (0.7–13.6 thousand tons/year of elements from sandstone), the Czech Republic (up to 22.1 thousand tons/year of elements from other rocks and additionally 46.2 thousand tons/year elements from sandstone in 2021), Slovakia (0.4–1.2 thousand tons/year of elements from marbles and other carbonate rocks) and Ukraine (up to 1.6 thousand tons/year of elements from marbles and other carbonate rocks; Figure 5).

The export volume of **worked dimension stones** fluctuated between 18.6 and 35.6 thousand tons/year in 2011–2019, and increased to 48.5–49.3 thousand tons/year in the last two years (Figure 4). The majority of deliveries accounting for **granites** (43–80%; 8.5–34.8 thousand tons/year); however, this is not as significant a dominance as was reported in the group of crude and roughly worked blocks and slabs. Worked dimension stones representing the group of **other rocks** (including sandstones) constituted between 15% and 47% of total exports (4.2–13.2 thousand tons/year). **Marbles and other carbonate rocks** were exported in small quantities, from 1.2 to 5.6 thousand tons/year (5–17% of total supplies; Figure 4). The most important recipient of various groups of work dimension stones was Germany (67–77% of total export volume; including 4.4–28.1 thousand tons/year of granite, up to 3.1 thousand tons/year of marble and other carbonate rocks, and 3.6–12.6 thousand tons/year of other rocks; Figure 5). Small amounts of worked dimension stones were also exported to other neighboring countries as well as to Switzerland and Austria.

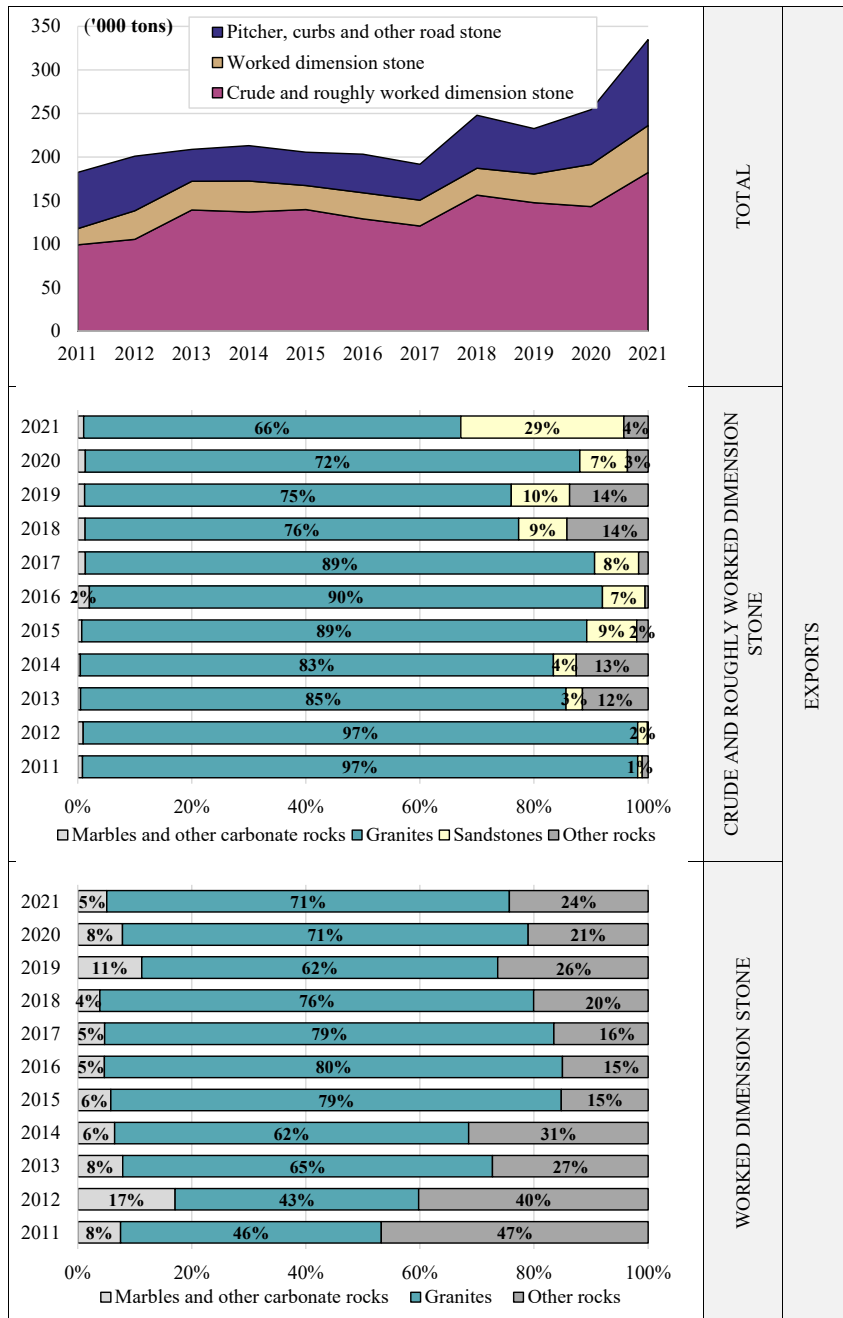


Fig. 4. The structure of dimension stone exports from Poland in the years 2011–2021 (authors' elaboration based on Statistics Poland data)

Rys. 4. Struktura eksportu kamieni blocznych z Polski w latach 2011–2021 (opracowanie autorów na podstawie danych GUS)

**Pitcher, curbs and other road stones** were exported in 2011–2020 in the amounts of 36.6–62.8 thousand tons/year, with an increase to about 78.7 thousand tons/year in 2021 (Figure 4). Deliveries were directed primarily to Germany (29.4–49.7 thousand tons/year) and by 2012 also to Slovakia (17.6–25.4 thousand tons/year; Figure 5). In 2021, a significant growth of exports volume (to 15.7 thousand tons/year from the level of a few hundred tons/year – a few thousand tons/year in 2011–2020; Figure 5) were reported to the Czech Republic. In addition, some amounts of pitcher, curbs and other road stones (a maximum of several thousand tons/year) were exported to Switzerland, Lithuania, Russia, Austria and Latvia.

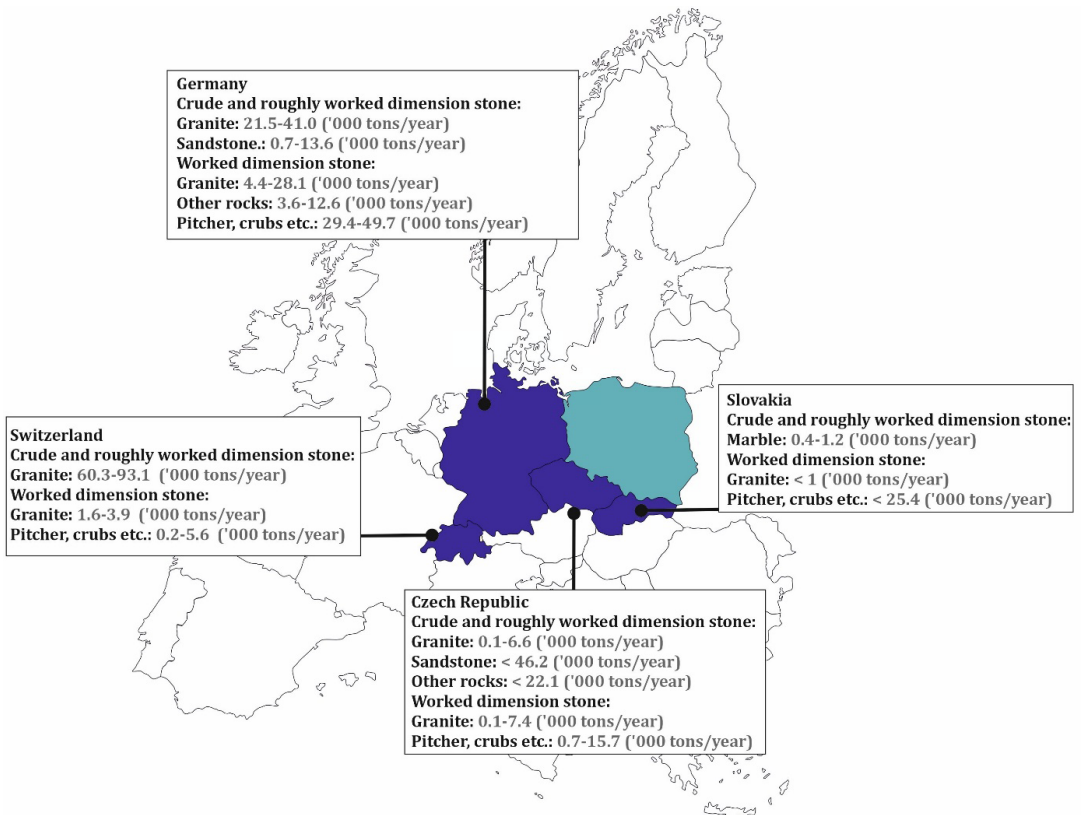


Fig. 5. The major export directions of dimension stones from Poland in the years 2011–2021 (authors' elaboration based on Statistics Poland data)

Rys. 5. Główne kierunki eksportu kamieni blocznych z Polski w latach 2011–2021 (opracowanie autorów na podstawie danych GUS)

## 2.4. Volume and structure of stone material domestic consumption

The volume of domestic apparent consumption of dimension and road stones, determined on the basis of official Statistics Poland data on production and foreign trade, was in the range of 3.8–7.4 million tons/year in 2011–2021 (Table 2). However, taking into

Table 2. The volume of consumption of dimension stones and smaller stone elements in Poland in the years 2011–2021 (in million tons/year)

Tabela 2. Wielkość zużycia kamieni blocznych i mniejszych elementów kamiennych w Polsce w latach 2011–2021 (mln ton/r)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Crude and roughly worked dimension stone											
Production <sup>1</sup>	5.9	3.8	3.6	3.6	3.5	3.3	3.2	4.3	4.1	4.4	4.1
Imports	1.1	1.3	0.2	0.2	0.4	0.4	0.2	0.1	0.2	0.2	0.2
Exports	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2
Consumption (apparent) <sup>2</sup>	6.9	5.0	3.7	3.7	3.8	3.6	3.3	4.2	4.2	4.5	4.1
Consumption (apparent) <sup>3</sup>	2.2	2.3	0.9	1.2	1.5	1.5	1.2	1.0	1.1	1.3	1.2
Pitcher, curbs and other road stones											
Production <sup>1</sup>	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.4	0.5	0.5
Imports	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
Exports	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Consumption (apparent) <sup>2</sup>	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4
Total volume											
Mining output <sup>4</sup>	1.5	1.4	1.2	1.5	1.5	1.5	1.4	1.4	1.4	1.7	1.8
Production <sup>1</sup>	6.2	4.1	3.9	4.0	3.8	3.6	3.5	4.6	4.5	4.9	4.6
Imports	1.4	1.5	0.4	0.5	0.6	0.6	0.5	0.4	0.5	0.4	0.4
Exports	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Consumption (apparent) <sup>2</sup>	7.4	5.4	4.1	4.3	4.2	4.0	3.8	4.8	4.8	5.0	4.7
Consumption (apparent) <sup>3</sup>	2.7	2.7	1.4	1.8	1.9	1.9	1.7	1.6	1.7	1.8	1.9

<sup>1</sup> According to the data of Statistics Poland.

<sup>2</sup> The volume of apparent consumption calculated taking into account official production data reported by Statistics Poland.

<sup>3</sup> The volume of consumption calculated taking into account data on the volume of dimension stone mining estimated on the basis of information from producers, yield of dimension blocks in the volume of deposit resources and data on the volume of extraction reported in the Balance of mineral deposit resources in Poland (BZZK 2021 and previous editions).

<sup>4</sup> Estimated volume of dimension stone mining output.

Source: Statistic Poland, BZZK 2021 (and previous editions).

account data on the volume of the domestic mining of dimension stones (blocks, lumps and smaller elements obtained from deposits of various types of rocks) estimated on the basis of information from producers, as well as taking into account the quantity of blocks (whenever available) and the volume of output from individual deposits reported in the Balance of mineral resources deposits in Poland (BZZK 2021 and previous editions), it is estimated that this level did not exceed 1.4–1.9 million tons/year, and only in 2011–2012 periodically increased to about 2.7 million tons/year (Table 2, Figure 6). Such a significant difference in comparison to the volume of apparent consumption calculated on the basis of Statistics Poland data is due to the fact that the statistics reported by this institution probably include stone materials at different stages of processing multiple times. This refers not only to dimension stones from domestic deposits but also to imported materials dressed in domestic stone plants. Crude and roughly worked stone elements were used in the largest quantities in Poland (0.9–2.3 million tons/year; Table 2). Significantly lower demand was recorded for road stones, such as pitcher and curbs (0.3–0.4 million tons/year; Table 2). It is estimated that demand for crude and roughly worked stone elements was predominantly met from domestic sources. The share of imports in total consumption structure accounted for ca. 10–23% in 2013–2021, and increased to ca. 43–49% in 2011–2012. It is estimated that dimension stones are utilized in Poland to the greatest extent in the civil construction and gravestones sector (75–90%), and subordinately in the road construction sector (10–25%; in the form of pitcher, curbs and paving slabs).

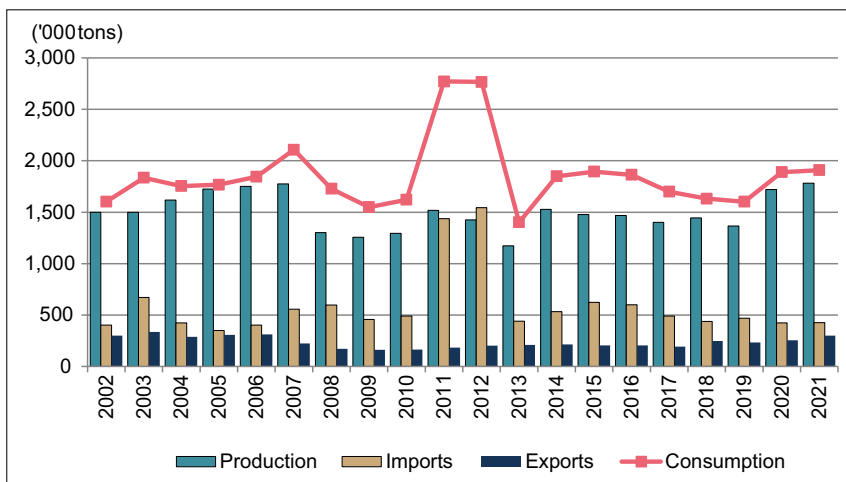


Fig. 6. Estimated volume of domestic consumption of dimension stone and smaller stone elements in Poland in the years 2002–2021

Rys. 6. Szacunkowa wielkość krajowego zużycia kamieni blocznych i mniejszych elementów kamiennych w Polsce w latach 2002–2021

## 2.5. Discussion of results

Poland has a long tradition of mining and the application of various types of stone materials for construction purposes. Domestic **granites** – currently utilized primarily as road stone, such as pitcher, curbs and paving slabs – has remained popular for centuries. The production of gravestones is also an important direction of their use. The dressing of granite blocks sourced from domestic deposits is overwhelmingly performed in stone plants located in the Strzegom area. A part of domestic granite production has been exported, primarily to Germany and Switzerland in the years 2011–2021. Granites are mainly exported in the form of crude and roughly worked stone materials (usually 80–90%), and only to a lesser extent in the form of worked stone elements. The first of these groups includes small-sized blocks (so-called ashlar blocks or wall stones), which in recent years have been exported in significant quantities to our western neighbors. However, the level of domestic production of granite products is lower in relation to the volume of domestic demand. For this reason, a substantial proportion of dimension granites utilized in Poland have been imported. This primarily applies to varieties of rocks, classified as so-called technical granites, with different petrographic characteristics, such as South African norites, Chinese granites, Ukrainian labradorites and Scandinavian red granites.

Imported stone materials, due to considerable variability in visual characteristics, are an excellent complement to the native granite varieties, which are of light gray color and have similar decorative qualities (with the exception of the pink-gray Karkonosze granite, which is obtained in small quantities). The share of imports (both raw and worked elements) in total domestic granite consumption generally accounted for no less than 20–30%, and in 2011–2012, they occasionally increased even to ca. 50–60%. The main supply sources are, for blocks and raw slabs, South Africa and India and, for worked dimension elements, primarily China (although the share of imports from this country in total export volume between 2011 and 2021 has decreased from 72 to 54%). Periodically, in 2011–2012 there was a strong development in the import of granite for hydrotechnical constructions from Scandinavia. Significant growth of supplies of worked elements from granite was reported from India, in the case of which, the volume of imports nearly doubled during the analyzed period of time. A particularly significant increase of supplies from this direction, and to a lesser extent also from Portugal (up to several thousand tons/year), was reported in 2021. This was related primarily to the limited availability of Chinese granite blocks caused by the coronavirus pandemic. The disruption of supply chains resulted from transportation problems and limited capacity at container ports. Shortages in the market for granite stone materials were compensated in part by an increase in the volume of blocks mined from domestic deposits.

Another trend that was observed in 2021 was the growth of deliveries of raw dimension granite from African countries, such as Angola, Zimbabwe and to a lower extent from Uruguay. It is worth noting that the unit values of crude and roughly worked granite elements from major suppliers vary depending on the direction of imports (PLN 1.5–1.9 thousand/ton

from India; PLN 0.9–1.1 thousand/ton from South Africa), but generally, they are at a much higher level compared to the unit values of exports (PLN 0.4–0.5 thousand/ton to Germany; PLN 0.7–0.8 thousand/ton to Switzerland). The exception was the delivery of rocks for hydrotechnical constructions from Sweden of very low unit values (PLN 80–90/ton), while generally, the unit values of supplies from this direction did not fall below PLN 0.6–0.8 thousand/ton.

The second group of rocks utilized in Poland in significant quantities as dimension stone are **sandstones**. Unlike granites, these rocks are mainly sourced from domestic deposits and the share of imports in the total volume of consumption does not exceed 1%. A number of sandstone varieties with considerable color variation, ranging from white, yellow, pink, gray to brown and brick-red, are extracted from mines located in different parts of Poland. These rocks are mined in the form of blocks and smaller elements of irregular shapes suitable for a variety of uses, primarily including architectural applications. The production of vertical cladding slabs for indoor and outdoor applications is among the most important directions for the use of dimension sandstones. Due to their susceptibility for dressing, they are also a valuable material for fireplaces, sculptures and various stone accessories. In turn, sandstone mined in the form of split tiles is used primarily in garden architecture and as a façade stone. Sandstone is the subject of trading with other countries only in small quantities. Indian red sandstones were among those imported to Poland, and small amounts of such stone materials were also periodically delivered from Germany and Ukraine. Exports remained higher than imports throughout the period under review. Germany was the main recipient of sandstone materials from Poland, with larger quantities exported to the Czech Republic only in 2021. The unit values of imported sandstone elements (PLN 0.8–2.1 thousand/ton) were significantly higher compared to those recorded for exports (PLN 0.1–1.2 thousand/ton).

**Marble and other carbonate rocks** are mined in Poland in marginal amounts and as a result, the demand for such stone materials is mostly covered by imports. They are primarily supplied in the form of worked elements. The systematic decline in the volume of deliveries (from more than 23 to just 14–15 thousand tons/year in 2018–2021) indicates the declining interest in this type of stone material in the domestic market. Due to the significant reduction in production volume from domestic mines, the main suppliers of marble and other carbonate rock worked elements used in Poland were Turkey, the Czech Republic, Germany, China and Italy. Simultaneously, the volume of such dimension stones exports was marginal. Due to the low level of trade, the unit values of imports and exports fluctuated over a wide range.

During the analyzed period 2011–2021, domestic production of **pitcher, curbs, paving slabs and other road stones** increased significantly from ca. 0.3 to 0.5 million tons/year. Its share in the total consumption of such products in Poland generally exceeded 90%. The volume of imports of pitcher and other road stones in the years 2011–2021 was at the level of 25–96 thousand tons/year. This included products from granite as well as those obtained from other varieties of rocks, such as basalts, syenites, and occasionally even limestones or sandstones. China provided more than half and periodically even ca. 85% of the total



volume of supplies. Until 2013, larger quantities of pitcher and other road stones were also imported from Slovakia. The volume of supplies from China has been significantly reduced in 2021 resulting in an increase in the domestic production of such products. At the same time, a growth in the export volumes was observed, which remained at the level of 37–65 thousand tons/year in 2011–2021, and increased to about 79 thousand tons/year in 2021. This was due to both an increase in sales to the largest foreign customer of pitcher, curbs and other road stones produced in Poland, namely Germany, and additionally, a significant growth of the export volume to the Czech Republic. Unit values of exports of this type of product to Germany were in the range of PLN 0.2–0.4 thousand/year in 2011–2021. By comparison, unit values of imports from China in the same period of time were in the range of PLN 0.4–0.6 thousand/year.

## Conclusions

In recent years, the demand for various types of dimension stones has been stable due to the numerous domestic investments in construction and road sectors. In particular, there was a significant growth of demand for granite stone elements from both domestic deposits and imported sources. The volume of dimension granite production in Poland increased from 1.2–1.4 million tons/year in 2011–2020 to about 1.6 million tons/year in 2021. The total volume of imports of raw and worked granite products in 2013–2021 accounted for 335–542 thousand tons/year and only in 2011–2012 was it at a significantly higher level (1.1–1.4 million tons/year) due to investments on the Baltic coast. The total volume of granite exports did not exceed 100.0 thousand tons/year during the analyzed period.

Sandstone is the second important group of rocks utilized primarily as architectural stone. The volume of the domestic mining of blocks and smaller stone elements reached 130–260 thousand tons/year in 2011–2021. The share of imported sandstones in the total consumption of these rocks in Poland constituted less than 1%. However, the termination of the extraction of some sandstone varieties from domestic mines (e.g. gray-colored sandstones from the Górká Mucharz and Barwałd deposits), which has been reported in recent years, may cause a necessity to import this type of rock from abroad in the future. Due to the significant domestic production potential for sourcing a range of sandstone varieties, the volume of exports of such stone materials exceeded the volume of their imports. However, it was still no higher than a few dozen thousand tons/year, except for an increase to tens of thousands of tons in 2021.

Stone materials representing other rock varieties (limestone, marble, dolomite, syenite) were used in small quantities in Poland. Regarding carbonate rocks, domestic mining has been severely reduced in recent years. As a result, the demand for such stone materials is mostly covered by imports, the total volume of which (for raw and worked products) has significantly decreased in recent years. This reflects a decline in interest in such stone materials on the domestic market. It particularly concerns marbles and highly compacted limestones

that are suitable for polishing which in our climate conditions are not appropriate for outdoor applications. However, the popularity of soft detrital limestones is of an increasing tendency, as the weathering conditions are not deteriorate their strength properties, but the level of domestic production of such dimension stones is still relatively small.

It is worth emphasizing that the significantly higher unit values of imported stone materials compared to those obtained in the exports lead to the conclusion that our domestic resource potential in terms of dimension stone production should be used to a greater extent whenever it is possible. This particularly refers to domestic granite mined in the Strzegom area, which could at least partially replace road stones, such as pitcher, curbs and paving slabs, which are imported in large quantities. Poland has an abundant resource base of rocks suitable for dimension stone production, recognized particularly in granites and sandstones deposits.

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**THE MANAGEMENT OF DIMENSION STONES IN POLAND IN THE YEARS 2011–2021****Key words**

dimension stones, granite, production, consumption, trade

**Abstract**

This paper presents data on the management of dimension stones in Poland in the period 2011–2021. The domestic production of rocks suitable for the production of slabs, pitcher and curbs, etc. is estimated and the major varieties of rocks utilized for these purposes are indicated. Data on raw and processed products with regard to imports and exports are presented for crude and roughly worked blocks and slabs, worked dimension stones as well as pitcher, curbs and other road stones. In the first two groups, data is reported separately for:

- ◆ marbles, limestones and other carbonate rocks,
- ◆ granites,
- ◆ sandstones (distinguished as separate category in crude blocks and slabs group),
- ◆ other rocks.

Data on the volume of production, imports and exports is utilized for the calculation of the apparent consumption of dimension stone in Poland. The conducted analyses revealed that its volume has been ranging from 1.4 to 1.9 million tons/year in 2013–2021 with the exception of the years 2011–2012 when it reached ca. 2.7 million tons/year. The most important group of rocks utilized in Poland as dimension stones are granites. These originated primarily from domestic deposits but they are also imported from various directions, primarily from the Republic of South Africa and India (crude blocks and slabs), China (worked dimension stones) as well as from Sweden and Norway in 2011–2012 (significant amounts of hydrotechnical stones). Another significant group of rocks utilized in Poland as dimension stones are sandstones (with a share of imports in total domestic consumption not exceeding 1%) while marbles, limestones and other carbonate rocks are of marginal importance (primarily imported in the form of worked dimension stones from China, the Czech Republic, Italy and Turkey).

**GOSPODARKA KAMIENIAMI BLOCZNYMI W POLSCE W LATACH 2011–2021****Słowa kluczowe**

kamienie bloczne, granit, produkcja, zużycie, obroty

**Streszczenie**

W pracy przedstawiono dane dotyczące gospodarki kamieniami blocznymi w Polsce w latach 2011–2021. Oszacowano wielkość krajowego wydobycia skał przydatnych do produkcji płyt, krawężników, kostki itp. oraz wskazano główne odmiany skał wykorzystywanych w tym celu. Dane o imporcie i eksporcie przedstawiono dla surowych lub wstępnie obrabianych bloków i płyt; obrabianych

elementów kamiennych oraz krawężników, kostki i innych kamieni drogowych. W pierwszych dwóch grupach dane podano oddzielnie dla:

- ♦ marmurów, wapieni i innych skał węglanowych,
- ♦ granitów,
- ♦ piaskowców (wyróżnionych jako odrębna kategoria wyłącznie w grupie surowych lub wstępnie obrobionych bloków i płyt),
- ♦ innych skał.

Do obliczenia wielkości zużycia pozornego kamieni blocznych w Polsce wykorzystano dane o wielkości produkcji krajowej, importu i eksportu. Przeprowadzone analizy wykazały, że jego łączny wolumen w latach 2013–2021 mieścił się w przedziale 1,4–1,9 mln ton/r., a jedynie w latach 2011–2012 osiągnął poziom około 2,7 mln ton/r. Najważniejszą grupą skał wykorzystywanych w Polsce jako kamienie bloczne są granity głównie ze złóż krajowych, ale także importowane, przede wszystkim z Republiki Południowej Afryki, Indii (surowe bloki i płyty) i Chin (obrobione elementy kamienne), a w latach 2011–2012, w znacznych ilościach, także ze Szwecji i Norwegii (kamień hydrotechniczny). Kolejną istotną grupę skał blocznych wykorzystywanych w Polsce stanowią piaskowce (udział ich importu w całkowitym zużyciu krajowym nie przekracza 1%), natomiast marmury, wapień i inne skały węglanowe stosowane są w budownictwie marginalnie (głównie importowane w postaci już obrobionych elementów z Chin, Czech, Włoch i Turcji).

