

### § 9. The Building Stones of Queensland.\*

1. **Bibliography.**—While little has been done in regard to the utilisation of the ornamental and building stones of Queensland, large quantities of good material are readily available in many areas.

The literature on the subject is scant, and the following list comprises the more important contributions:—"The Sandstone Quarries of the Southern District," Votes and Proceedings III., Queensland Parliament 1888, pp. 1021, 1044; "Queensland Stones for Architectural and Monumental Purposes," by L. C. Ball, B.E., Government Mining Journal 1905, p. 457; "Limestones in the Central and Southern Districts," by L. C. Ball, B.E., Pub. 194, Queensland Geological Survey, 1904; "Building Stones of Queensland," by H. C. Richards, D.Sc., Proc. Roy. Soc. Qld., 1918, pp. 97-157; also a small paper by the same author on the "Building Stones of St. John's Cathedral, Brisbane," Proc. Roy. Soc. Qld., 1911.

2. **Distribution.**—(i) (a) *General-Granites* occur in many widespread areas throughout the State and frequently in close association with the more important centres of population. Only in Brisbane, however, have granites been used to any extent, and while the local stone from Enoggera has been largely employed, it will probably be supplanted by other granites, e.g., from Greymare, unless the objections to the pyrites can be overcome.

(b) *Trachytes and Rhyolites* are abundant in the south-east portion of the State, and are found close to Brisbane. These rocks have not yet been used, but they will undoubtedly be drawn upon in the future. At the Glass House Mountains, the Flinders Range near Ipswich, and near Esk, excellent material occurs of good appearance, free working qualities, and in close proximity to the railway line.

(c) *Sandstones* of Triassic and Jurassic Age are distributed throughout large areas in Queensland, and material from many localities has been tried. The sandstones are freshwater lacustrine deposits, and considerable variation occurs in the beds. In the south-eastern portion of the State several good sandstones have been worked, but some of the best weathering material, e.g., from Goodna and Murphy's Creek, has been worked out.

At the present time warm brown sandstones in large quantities are available at Helidon, and at Yan Gan, near Warwick. Both these stones give very good results in the Southern Queensland climate if kept free from moisture; they wear cleanly and give a sharp arris.

In the central district at Stanwell, 20 miles west of Rockhampton, abundant quantities of a very serviceable light-brown easy-working sandstone occur. This stone is also one of the Mesozoic lake deposits.

In Northern Queensland a sandstone is found between Pentland and Torrens Creek to the west of Charters Towers. This stone has given good results when used for monumental purposes at Charters Towers and Townsville.

It will be seen, therefore, that in Southern, Central, and Northern Queensland good serviceable sandstones are available.

(d) *Marbles and Limestones.* It is within recent years only that Queensland has commenced to exploit local deposits of marble and limestone for monumental purposes. Hitherto the limestones have been used for fluxing and lime-producing purposes only.

(e) *Serpentine.* Queensland serpentine has not so far been used, although there are large deposits in different parts of the State. The value for ornamental work has not yet been determined, but near Kilkivan a dark-green serpentine of good quality occurs over a considerable area. At Cawarral there is a large belt running north-west from the mouth of the Fitzroy River. At Broken River, 130 miles west of Townsville, specimens taking a good polish have been obtained. At Pine Mountain, near Ipswich, and in other localities in the Brisbane Valley, deposits of serpentine have also been found.

(ii) *Tabular Statement of Distribution, &c.* Tables A, B, and C hereunder give detailed information in regard to name, locality, character, approximate quantities available, and extent of use of the igneous, sedimentary, and metamorphic building stones of Queensland.

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## (A) IGNEOUS

Building Stone.	Locality.	Quantity.
Granite (light gray)	Enoggera, 3 miles west of Brisbane	Unlimited quantity, abounding over an area of about 12 square miles
Granite (dark gray)	Mount Crosby, 30 miles west of Brisbane, near Brisbane River	Unknown, but probably fairly extensive ..
Granite (gray) ..	Greymare, 20 miles west of Warwick and 180 miles from Brisbane	Unlimited quantity, but no proper quarries yet opened up. Only large surface boulders have been worked, these being remarkable for their freshness
Granite (pale pink)	Magnetic Island .. ..	Unknown .. .. .
Granite (pink to gray)	Mackay, near the mouth of the Pioneer River	About 1 mile in diameter .. ..
Granite (red) ..	Townsville .. ..	About 1 mile in diameter near the town, but a much larger area to the east of Townsville
Granite (light gray)	Cooktown .. ..	Area 3 miles in diameter .. .. .
Granite (pale red) ..	Stanthorpe .. ..	A very extensive area .. .. .
Granite (dark gray)	Wallangarra .. ..	Abundant .. .. .
Rhyolite and Trachyte (light gray)	Glass House Mountains, 40 miles north of Brisbane (several peaks)	Unlimited .. .. .
Rhyolite (light yellow-brown)	Glen Rock, Esk, 70 miles from Brisbane	Abundant .. .. .

\* Dates in brackets as above indicate

## (B) SEDIMENTARY

Building Stone.	Locality.	Quantity.
Sandstone (light brown), Triassic Age	Breakfast Creek, Brisbane ..	Quarries which have been opened up are now worked out

STONES.

Character.	Examples.
Light-coloured, fine-grained granite of pepper-and-salt appearance, composed of clear quartz, cloudy feldspar, and black mica, and, in some cases, hornblende. Abundant small crystals of pyrites which, on exposure, oxidise to limonite. Average grain size, 1.5 to 2 mm.; density, 2.59. The stone shows considerable variation, and certain portions of the granitic area are comparatively free from pyrites. Free from acid and basic segregations	Base of the Executive Building, Brisbane (1901-5)*; Shaw and Sons' building, Brisbane (1904); steps of Central Technical College, Brisbane (1912-14); kerbing stones along tram lines in city of Brisbane (1916)
Dark-gray rock of medium grain, average grain size being 2 mm., composed of plagioclase, feldspar, augite, and biotite. It is a very handsome stone, and works well	Three courses in the base of the Executive Building, Brisbane (1901-5); base of the Royal Insurance Building, Brisbane (1906); cutwater in the Albert Bridge, Indooroopilly (1893-5)
A light-gray granite made up of quartz, feldspar, and black mica. The rock exhibits a slight gneissose character. It is an even-grained rock of medium grain size, quartz and feldspar crystals averaging 2 mm. in length, and the biotite flakes 1 mm. The most suitable gray granite yet used in Brisbane; works freely; density, 2.66	Base and kerbing of the Technical College, Warwick; base of the Government Savings Bank, Brisbane (1914)
Very light-coloured pink granite of medium grain, composed of quartz, feldspar, biotite, hornblende, and magnetite; the dark minerals very much in the minority	Base course and steps of the Customs House, Townsville
Pink to gray rock of very variable composition and appearance ..	Breakwater at the mouth of the Pioneer River
Medium to coarse-grained red granite composed of clear quartz, feldspar both pink and white,—the former predominates—and small patches of chlorite	Used in breakwater
Light-gray porphyritic stone .. .. .	Base of Captain Cook's Monument
Pale-red granite composed of quartz, orthoclase, and biotite. Average grain size, 3-4 mm.	Limited use for monumental purposes
Dark-gray porphyritic granite; coarse-grained, with large crystals of light-pink orthoclase up to 1½ inches long set in a ground mass of quartz, orthoclase, plagioclase, hornblende, augite, and sphene; dark minerals much more abundant	..
Light-gray fine-grained rocks, sometimes distinct bluish-gray, composed of sanidine, feldspar, and augite. Many of the stones are of extremely handsome appearance, and show very pretty markings owing to the distribution of the dark minerals throughout the rocks. They are free working stones and occur in easy conditions for quarrying and handling. Density, 2.47-2.71	..
A very fine-grained rock composed of quartz and feldspar; works easily and takes a sharp arris. Density, 2.43	Not used to date, except for road metal

years of erection of building.

STONES.

Character.	Examples.
Very friable coarse sandstone; average grain size, .5 mm.; felspathic cement forming more than 50 per cent. of the stone. Rather variable, and not a good weathering stone	Upper story, Commercial Banking Co. (1866); old portion of G.P.O., Brisbane (1871-4); facings of St. Stephen's Cathedral (1874); base course, Roma-street Railway Station (1875); Australian Bank of Commerce; &c.

## (B) SEDIMENTARY

Building Stone.	Locality.	Quantity.
Sandstone (light brown), Triassic Age	Goodna, 15 miles west of Brisbane	The best stone which occurred in Jeay's Quarry was worked out, but will probably be picked up again in adjacent areas if required
Sandstone (dark brown), Triassic Age	Calvert, 41 miles west of Brisbane	Fairly abundant .. .. .
Sandstone (gray), Triassic Age	Lockyer Creek, 76 miles west of Brisbane	Fairly abundant .. .. .
Sandstone (brown, white, pink), Jurassic Age	Helidon, 72 miles west of Brisbane	Large quantities available, but rather scattered; good quarries not usual
Sandstone (white), Triassic Age	Murphy's Creek, 82 miles from Brisbane	Has not been worked of recent years, as the best quarries have been worked out; amount available unknown
Sandstone (white), Jurassic Age	Highfields, 90 miles from Brisbane	A large amount available .. .. .
Sandstone (brown), Jurassic Age	Yangan, 13 miles from Warwick and 172 miles from Brisbane	Large quantities readily available .. .. .
Sandstone (brown), Triassic Age	Swan Creek (Mount Sturt), 9 miles from Warwick	A moderate amount available .. .. .
Sandstone (brown), Triassic Age	Warwick, 150 miles from Brisbane	A large quantity still available .. .. .
Sandstone (light brown)	Stanwell, 20 miles west of Rockhampton	Abundant .. .. .
Tuff (white, brown, pink, and gray)	Brisbane .. .. .	Unlimited .. .. .

STONES—*continued.*

Character.	Examples.
<p>Medium-grained sandstone, with a clayey cement, average grain size being .25 mm. Colour, light brown or light pink, frequently with well-marked concentric bandings. The stone has a warm appearance, wears cleanly, and has excellent weathering properties. The stone obtained from Jeay's Quarry has weathered excellently; that obtained from Geary's Quarry and used in St. Stephen's Church, Brisbane, has weathered very poorly</p>	<p>Jeay's Quarry supplied the stone for the old Government House (University) (1862); Brisbane Town Hall (1864); Parliament House (1865-7)</p>
<p>Very friable, soft, dark-brown sandstone: fine-grained, with an average grain size of .20 mm.; particles angular to sub-angular set in clayey cement stained with limonite</p>	<p>In railway tunnels and culverts between Grandchester and Helidon; stone facings in Perkins' Brewery, Brisbane</p>
<p>Gray sandstone, of medium grain size ° . . . . .</p>	<p>Used for kerbings in the Dry Dock, South Brisbane (1867-71)</p>
<p>There are several varieties of this sandstone, and the following have been used:—White, brown, buff, and pink. The pink stone has the best weathering properties, while the brown stone has a very warm appearance and has given excellent results. A large number of quarries have been opened up, but most of them are of a shallow nature. The stone has rather a high percentage of clayey cement, which may be stained with iron oxide or with iron and manganese oxides. It has an average grain size of .25, the grains being angular to sub-angular. Concentric iron banding is very common. The stone works freely, giving a good aris, and weathering cleanly</p>	<p><i>Brown Stone.</i>—Executive Building, Brisbane (1901); Anglican Cathedral, Brisbane (1909); Government Savings Bank, Brisbane (1915) <i>White Stone.</i>—Central Railway Station (1901); second wing of Treasury Building (1890) <i>Pink Stone.</i>—Central Railway Station (1901); South Brisbane Town Hall (1891)</p>
<p>A coarse-grained white stone, rather irregular; average grain size, .4 mm.; cementing medium clayey and abundant. It is a very good weathering stone, and one of the best used in Brisbane</p>	<p>Portion of G.P.O. (1871); Public Library (1877); Queensland National Bank, Brisbane (1882); colonnades of Parliament House</p>
<p>A soft white stone, even grained; average grain size, 4 mm.; cementing clay material very abundant; bedding pronounced. Stone very variable in quality</p>	<p>First wing of Treasury Building, Brisbane (1887)</p>
<p>Fine-grained stone, warm brown in colour, frequently presenting concentric iron staining; average grain size, .20 mm. Works freely, takes a very sharp aris; thick beds in good position for working; excellent weathering stone</p>	<p>Executive Building, Brisbane (1901); Royal Insurance Company's Building, Brisbane (1906); in Warwick—in the Police Building, Post Office, and Technical College</p>
<p>Brown sandstone, of a somewhat similar character to the Yangan sandstone, but rather more cement, and considerably inferior in quality</p>	<p>Warwick Town Hall fronts and old Railway Station, Warwick (1888)</p>
<p>Several quarries have been worked. The stone is rather coarse-grained, and shows frequent current bedding, brown in colour, and with abundant clay cement. Only used in Warwick</p>	<p><i>Mount Tabor Quarry.</i>—Police Building (1885); rear portion of Town Hall; Queensland National Bank (1880) <i>Sidling Quarry.</i>—Anglican Church (1867); R.C. Church; Methodist Church; and Masonic Hall <i>Mitchell's Quarry.</i>—Convent (1892)</p>
<p>Medium-grained, light-brown sandstone, which works well; takes a fair aris, and weathers very cleanly; average grain size, .5 mm.; stone needs careful selection. Used in Rockhampton very largely</p>	<p>The following Rockhampton structures:—Anglican Cathedral, Commonwealth Bank, Bank of Australasia, Post Office, R.C. Cathedral, and Customs House</p>
<p>Pyroclastic of a Rhyolitic character, which has been much silicified. Colours—white, brown, pink, and green, occurring with iron and manganese staining. Stone composed of quartz, orthoclase, and plagioclase set in a devitrified felspathic ground mass. Needs very careful selection, as there is great variability in its weathering properties</p>	<p>Normal School (1863); St. Stephen's Cathedral (1874); St. Paul's Presbyterian Church (1887); St. John's Cathedral (1909); very largely used for base courses of several Brisbane buildings; also for kerbing, and for road metal subject to light traffic</p>

## (C) METAMORPHIC

Building Stone.	Locality.	Quantity.
Marble .. ..	Ulam, 25 miles south of Rockhampton	Unknown, but believed to be considerable ..
Marble .. ..	Gladstone .. ..	.. ..
Marble .. ..	Raglan, 10 miles above the mouth of the Fitzroy River	Considerable deposits occur .. ..
Marble .. ..	Rockhampton District ..	.. ..
Marble .. ..	Northumberland Island, 14 miles from the mainland, midway between Rockhampton and Mackay	.. ..
Marble .. ..	Broken River, 130 miles west of Townsville	.. ..

## TESTS ON

3. Tests of Queensland Sandstones.—The following table shows the results of tests of

Stone.	Quarry.	Colour.	Specific Gravity.	Weight in lbs. per cubic foot.	Absorption in per cent. of dry weight.
Helidon Sandstone .. ..	Wright .. ..	Brown ..	{ 2.42	151	4.80
			{ 2.42	151	4.80
Helidon Sandstone .. ..	Wright .. ..	Brown ..	{ 2.26	141	..
			{ 2.26	141	2.8
Helidon Sandstone .. ..	Wright .. ..	Brown ..	{ 2.30	143	..
			{ 2.30	143	3.55
Helidon Sandstone .. ..	Miller .. ..	Brown ..	{ 2.31	144	4.36
			{ ..	148	..
			{ ..	148	..
Helidon Sandstone .. ..	Pearson .. ..	White ..	{ 2.21	138	..
			{ 2.21	138	3.66
Helidon Sandstone .. ..	Pearson .. ..	Pink ..	{ 2.37	148	..
			{ 2.37	148	3.35
Helidon Sandstone .. ..	Pearson .. ..	Brown ..	{ 2.26	141	..
			{ 2.26	141	4.20
Helidon Sandstone .. ..	Phippard .. ..	White ..	{ 2.33	145	..
			{ 2.33	145	2.73
Yangan Sandstone .. ..	Midson .. ..	Brown ..	{ 2.18	136	..
			{ 2.18	136	8.7
			{ 2.18	136	..
Murphy's Creek Sandstone ..	.. ..	Brown ..	{ 2.41	150	..
			{ 2.41	150	..
			{ 2.41	150	5.0
Calvert Sandstone .. ..	Beatty and Walsh ..	Brown ..	{ 2.39	149	4.47
			{ ..	..	..
Murphy's Creek Sandstone ..	.. ..	White ..	{ 2.18	136	5.1
			{ 2.30	144	3.7
Highfields Sandstone .. ..	.. ..	White ..	{ ..	..	4.8
			{ ..	..	7.0
Moggill Sandstone .. ..	Lyons .. ..	.. ..	{ 2.40	150	3.04
			{ 2.39	149.4	3.0
Lockyer Creek Sandstone ..	.. ..	.. ..	2.45	153	3.7

STONES.

Character.	Examples.
A coarse white marble, which is now being opened up, and is of considerable promise for mural and staircase purposes	..
Several deposits of white to fine-grained pink, blue, and red marble, much of which is fit for monumental purposes. The most conveniently situated deposits are at Calliope	..
..	..
Large areas of pink to blue limestone to the north of the Fitzroy River at 4 and at 20 miles above Rockhampton. At Marmor, 28 miles south of Rockhampton, there are large deposits of marbles of different colours, particularly dark-blue marble, with large en-crinites	Hitherto used mostly as a flux at Mount Morgan
White, pink, and blue marbles, uniform in colour, also variegated and mottled varieties, occur on Marble, Hunter, and Iron islands	..
Fine marbles, taking a good polish .. .. .	..

QUEENSLAND SANDSTONES.

various Queensland sandstones :—

Resistance to Crushing.					Reference Authority.	Remarks as to object of Tests and Character.
Size of Specimen in inches.	Cracking Pressure in lbs.	Crushing Pressure in lbs.	Crushing Resistance in tons per sq. foot.	Crushing Resistance in lbs. per sq. inch.		
4 x 4 x 4 4 x 4 x 4	36,000 42,500	39,590 49,690	159.10 201.20	2,475 } 3,130 }	P.W.D.* ..	Executive Building tests, 1901
4 x 4 x 4 4 x 4 x 4	.. ..	81,900 58,940	326.00 233.00	5,076 } 3,634 }	P.W.D. ..	{ Cent. Tech. Col., 1911, cr. dry on bed { Cent. Tech. Col., 1911, cr. wet on bed
6 x 3 x 3 6 x 3 x 3	.. ..	43,680 33,720	310.13 238.55	4,824 } 3,710 }	Rly. Dept. ..	{ Crushed dry on bed, C.R.S., † 1900 { Crushed wet on bed, C.R.S., 1900
4 x 4 x 4 4 x 4 x 4	42,560 41,440	51,744 41,440	.. ..	328.50 } 5,110 } 3,234 } 2,590 }	P.W.D. ..	{ Govt. Printing Office tests, 1911 { Govt. Savings Bank tests, 1915
6 x 3 x 3 6 x 3 x 3	.. ..	53,570 37,470	388.7 268.5	6,047 } 4,176 }	Rly. Dept. ..	{ Crushed dry on bed } { Crushed wet on bed }
6 x 3 x 3 6 x 3 x 3	.. ..	79,050 63,480	558.1 450.4	8,682 } 7,007 }	Rly. Dept. ..	{ Crushed dry on bed } { Crushed wet on bed }
6 x 3 x 3 6 x 3 x 3	.. ..	46,760 27,210	332.2 197.7	5,168 } 2,997 }	Rly. Dept. ..	{ Crushed dry on bed } { Crushed wet on bed }
6 x 3 x 3 6 x 3 x 3	.. ..	50,760 32,780	360.7 231.8	5,612 } 3,606 }	Rly. Dept. ..	{ Crushed dry on bed } { Crushed wet on bed }
4 x 4 x 4 4 x 4 x 4 4 x 4 x 4	.. .. ..	40,560 43,120 50,610	163.0 173.2 203.3	2,535 } 2,695 } 3,163 }	P.W.D. ..	Executive Building tests, 1901
4 x 4 x 4 4 x 4 x 4 4 x 4 x 4	.. .. ..	52,470 57,670 59,400	210.9 231.8 238.7	3,280 } 3,605 } 3,712 }	P.W.D. ..	Executive Building tests, 1901
.. ..	.. ..	.. ..	240.6 288.3	3,733 } 4,485 }	Rly. Dept. ..	Bremer Bridge test, 1896
.. ..	.. ..	.. ..	.. ..	.. } .. }	Rly. Dept. ..	Brisbane Dry Dock tests, 1875
.. ..	.. ..	.. ..	.. ..	.. } .. }	W. Hamlet W. H. Dixon	Treasury Building tests, 1888 1886
.. ..	.. ..	.. ..	.. ..	.. } .. }	Rly. Dept. ..	Brisbane Dry Dock tests, 1875
..	..	..	..	..	Rly. Dept. ..	Brisbane Dry Dock tests, 1875

\* P.W.D.—Public Works Department.

† C.R.S.—Central Railway Station.