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ONTARIO
DEPARTMENT OF MINES

BUILDING STONES OF ONTARIO
PART IV
SANDSTONE

By
D. F. HEWITT

INDUSTRIAL MINERAL REPORT NO. 17

1964

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BUILDING STONES OF ONTARIO

PART IV: SANDSTONE

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The writer wishes to thank the many quarry operators who supplied information for this report and provided access for the examination of their properties.

BUILDING STONES OF ONTARIO

PART IV: SANDSTONE

By D.F. Hewitt¹

INTRODUCTION

Sandstones have been widely used as building stones in southern Ontario due to the ready availability of the Medina and Potsdam sandstones in the vicinity of Toronto, Kingston and Ottawa. A great many attractive sandstone buildings may be seen in the cities and towns of southern Ontario. An example of the use of Medina red sandstone is the Parliament Buildings at Queen's Park in Toronto. Grey Medina sandstone from Georgetown has been used in the Royal Ontario Museum, Toronto. Grey Medina sandstone is used in the buildings of the University of Western Ontario, and in some of the buildings at the University of Toronto such as Hart House, Knox College and Trinity College. Recent quarrying of the Potsdam sandstone in the vicinity of Kingston has led to the use of salmon mottled "Kingston Hue" ashlar in many new churches in southern Ontario including St. Eugene's in Hamilton, Port Nelson United in Burlington, Our Lady of Fatima in Scarborough, St. Anselm's in Leaside, Holy Spirit church in Agincourt and many others.

1

Senior Geologist, Industrial Minerals, Ontario Department of Mines.

The principal sandstone quarrying areas in Ontario are in the Limehouse-Georgetown-Inglewood area where Medina sandstone is quarried and in the Kingston area where Potsdam sandstone is quarried. Potsdam sandstone is quarried to a minor extent near Perth and Ottawa. Production is mainly ashlar, flagstone, steps and copings, but large mill blocks for sawing are produced by Primeau Argo Block Company near Glen Williams.

COMPOSITION

The sandstones used for building stone in Ontario are composed predominantly of quartz grains cemented by silica or carbonate cement. The hardness and friability of the sandstone depends to a large degree on the type of cementation and the degree of recrystallization of the sandstone. Some beds are quite hard and quartzitic. The sandstones with a lime cement tend to be more friable than those with silica cement.

Typical chemical analyses of Potsdam, Medina and Oriskany sandstones are given in the accompanying table:

	(1)	(2)	(3)
	Potsdam sandstone	Medina sandstone	Oriskany sandstone
SiO ₂	98.61	93.80	97.04
Al ₂ O ₃	0.47	1.21	0.30
Fe ₂ O ₃	0.15	0.09	0.08
FeO	0.10	N.D.	N.D.
CaO	0.13	1.90	0.59
MgO	0.05	0.11	0.12
S	0.02	N.D.	N.D.
L.O.I.	0.35	1.78	1.02

- (1) Average of 12 samples, Kingston area (Keith 1949).
- (2) Milton, Ontario (Hewitt, 1963).
- (3) Cayuga, Ontario (Hewitt, 1963).

COLOUR

Potsdam sandstone quarried in Ontario is of varied colouration ranging from grey and white to salmon, red, mottled, lilac, yellow or purple. Frequently the colouration is present in streaks, bands or mottling. The colour is due primarily to oxides of iron. Medina sandstone is grey, red or mottled.

STRUCTURE AND TEXTURE

The sandstones are usually well-bedded with individual beds ranging from one or two inches to as much as 8 feet in thickness. Within the beds themselves there is frequently a prominent bedding lamination developed which allows the beds to be split parallel to the bedding. This bedding lamination is referred to in the trade as "reed", and stone with a good reed is desirable. In the Medina sandstone a good even bedding is desirable and crossbedding is objectionable. However in the Potsdam sandstone massive crossbedding on a large scale is present and quarries have been developed using the individual crossbeds. Where grain or "reed" is not present in the stone it cannot be split parallel to the bedding and the quarry men term the stone "livery". Joints are generally widely spaced.

The Potsdam formation is a mature sandstone of medium grain size and the sandstone is generally composed of rounded quartz grains cemented by silica or carbonate. The Medina sandstone is finer-grained, grains are less well-rounded, and silica content tends to be lower than in the Potsdam.

PHYSICAL SPECIFICATIONS

The accompanying table gives physical specifications for specimens of Potsdam, Medina and Oriskany sandstone from Parks, 1912. Specific gravity of these sandstones vary from 2.63 to 2.67 and weight per cubic foot from 141 to 156 pounds. Pore space is high, varying from 4.9 to 14.9; absorption varies from 2.0 to 6.6 percent. Crushing strength varies from 11000 to 32000 pounds per square inch and transverse strength from 400 to 2200 pounds per square inch.

Physical specifications for sandstones currently being produced in Ontario are given in subsequent descriptions of operating quarries. Absorptions in Potsdam sandstone currently produced in Ontario average less than one percent.

POTSDAM SANDSTONE

The Potsdam (or Nepean) sandstone of Cambrian age outcrops on both sides of the Precambrian Frontenac axis, in Storrington and Pittsburgh townships near Kingston, from Brockville to Westport, in the Perth and Carleton Place areas and in March and Nepean townships near Ottawa.

PHYSICAL SPECIFICATIONS FOR ONTARIO SANDSTONES

POTSDAM SANDSTONE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sample No.	2.67	2.66	2.63	2.65	2.63	2.65	2.66	2.66	2.66
Specific gravity	144.86	152.10	156.01	150.38	153.50	155.36	146.01	141.06	154.95
Weight per cu. ft., lbs.	12.41	8.24	4.95	8.97	7.22	5.96	12.04	14.87	6.55
Pore space, %	6.34	3.4	1.98	3.72	2.93	2.37	5.16	6.59	2.64
Ratio of absorption %	12778.	11221.	31793.	15459.	22032.	21627.	21715.	12590.	17949.
Crushing strength, p.s.i.	1162.	619.	1635.	417.	1620.	1835.	1614.	568.	2186.
Transverse strength, p.s.i.									

1
5
1

- (1) Potsdam sandstone, Gildersleeve quarry, lots 8-10, concession V, Pittsburgh township, Frontenac county (Parks 1912, p.123).
- (2) Potsdam sandstone, Young quarry, Westport (Parks 1912, p.127).
- (3) Potsdam sandstone, Wilson quarry, Allan's Mills, lot 16, concession I, Bathurst township, Lanark county (Parks 1912, p.131).
- (4) Potsdam sandstone, Hughes quarry, lot 26, concession VII, N. Elmsley township, Lanark county (Parks 1912, p.129).
- (5) Potsdam (Nepean) sandstone, Tillson quarry, Bell's Corners, lot 6, concession II, Ottawa Front, Nepean township, Carleton county (Parks 1912, p.135).
- (6) Potsdam (Nepean) sandstone, Tillson quarry, Bell's Corners, lot 6, concession II, Ottawa Front, Nepean township, Carleton county (Parks 1912, p.135).
- (7) Medina sandstone, Logan quarry, lot 26, concession VIII, Esquesing township, Halton county (Parks 1912, p.148).
- (8) Medina sandstone, Orangeville, lot 6, concession I, Mono West township, Dufferin county (Parks 1912, p.160).
- (9) Oriskany sandstone, lot 47, concession I, Oneida township, Haldimand county (Parks 1912, p.165).

At the present time the principal quarry operations, those of Kingston Quarries Limited, are along the Rideau waterway in Storrington and Pittsburgh townships.

Kingston

Kingston Quarries Limited

Hughes Property

Lots 8 and 9, Concession V, Pittsburgh Township

Kingston Quarries Limited operate three sandstone quarries on the Hughes farm, lots 8 and 9, concession V, Pittsburgh township, Frontenac county, on the south shore of the Rideau waterway. This is the old Gildersleeve quarry described by Parks (1912, p.123).

The first or westerly quarry has an area of about 200 by 80 feet with a 4- to 6-foot face exposing medium-grained, even-bedded, grey Potsdam sandstone in beds 2 to 6 inches thick. The stone is mottled with black carbonaceous spots and has some rusty iron stains. The trade name is "Rustic Hue". Two sets of joints were observed striking N.40°W. and dipping vertically, and striking N.40°E. and dipping 80°E.

Two other quarry openings are located near the river shore a few hundred yards to the northeast. The second quarry measures about 100 by 400 feet with a 10-foot face of medium to thin bedded, even bedded, medium-grained grey Potsdam sandstone. Beds range from 3 to 12 inches in thickness. The

sandstone dips gently to the northeast. The grey sandstone is known as "Lilac Hue".

The third quarry, which lies 100 feet east of the second quarry, has a 6- to 9-foot face and the stone is exposed over a length of about 200 feet. Two feet of thick bedded sandstone is underlain by two feet of cross-bedded sandstone and 5 feet of thin bedded grey to buff sandstone with some rusty spots. The sandstone dips 10°S.E. In the crossbedded sections individual beds may thicken down dip.

The sandstone is largely quarried by hand, using bars and wedges with occasional drilling and black powder. Fork lift trucks are employed to pry up the individual beds. The stone is split by a gasoline driven guillotine.

Physical properties of the grey sandstone (No.72) are as follows:

Compressive strength, p.s.i., maximum: 27250;
minimum: 18400;
average: 21758;

Absorption, 0.65 percent;

Bulk specific gravity, 2.54;

Weight per cubic foot, 158 pounds;

Abrasive hardness, 46.1.

Chemical analysis of the grey Potsdam sandstone from this property is as follows:



Hughes property of Kingston Quarries Limited.



Well bedded and crossbedded Potsdam sandstone at the Hughes property of Kingston Quarries Limited.

	Percent
SiO ₂	96.73
Fe ₂ O ₃	0.63
Al ₂ O ₃	0.86
Ignition loss	1.00
	<hr/>
Total	99.22

Kingston Quarries Limited

Sloan Farm

Lot 11, Concession VI, Storrington Township

There are 5 small quarry openings on the Sloan farm lot 11, concession VI, Storrington township, Frontenac county, operated by Kingston Quarries Limited. Quarry faces range from 3 to 10 feet in height. Crossbedding is common and two of the quarries are in crossbedded sections which dip 10 to 20°E. The stone is a medium to thin bedded buff and salmon pink to red Potsdam sandstone. It is known as "Kingston Hue".

Tree-like cylindrical sandstone concretionary structures up to three feet in diameter may be seen at this locality.

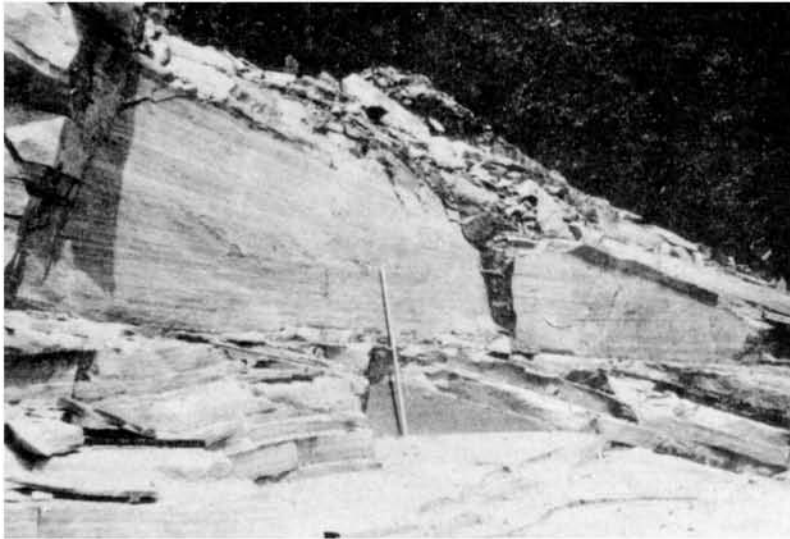
Physical specifications of red Potsdam sandstone (No.70) from this locality are as follows:

Compressive strength, p.s.i., maximum: 34250;
minimum: 16000;
average: 22200;

Absorption, 0.85 percent;

Bulk specific gravity, 2.50;

Weight per cubic foot, 156 pounds;



Crossbedded Potsdam sandstone at Sloan quarry of Kingston Quarries Limited.



Bedding and crossbedding in Potsdam sandstone, Hughes property of Kingston Quarries Limited.

Abrasive hardness, 67.9.

Chemical analysis of the "Kingston Hue" sandstone is as follows:

	Percent
SiO ₂	98.05
Fe ₂ O ₃	1.57
Ignition loss	0.35
	<hr/>
Total	99.97

Physical specifications of buff Potsdam sandstone (No.71) from this locality are as follows:

Compressive strength, p.s.i., maximum: 15400;
minimum: 12825;
average: 14112;

Absorption, 0.66 percent;

Bulk specific gravity, 2.50;

Weight per cubic foot, 156 pounds;

Abrasive hardness, 53.5.

Chemical analysis of the red Potsdam sandstone is as follows:

	Percent
SiO ₂	97.80
Fe ₂ O ₃	0.63
Al ₂ O ₃	0.96
Ignition loss	0.45
	<hr/>
Total	99.84

Argo Block Quarry

West Half, Lot 18, Concession VIII, Storrington Township

In 1960 and 1961 Argo Block Company operated a small sandstone quarry on the southeast shore of Cranberry Lake in the west half of lot 18, concession VIII, Storrington township, Frontenac county. About 5 feet of sandstone was quarried from the top of a 20-foot cliff of thick-bedded, grey, buff and red brown Potsdam sandstone. The thickest bed quarried is 24 inches. The beds are thicker and more massive than at the other quarries. Vertical joints strike N.10°E. There is minor crossbedding. Brown iron staining is common.

Norman Quarry

Lot 18, Concession VIII, Storrington Township

A small sandstone quarry has been opened on lot 18, concession VIII, Storrington township, Frontenac county about one quarter mile north of the Argo Block quarry. Three to five feet of thick bedded, well banded red and buff Potsdam sandstone has been quarried at the top of a 15-foot cliff. The sandstone dips 10°S. Concentric concretions were noted in the section.

Battersea

Lot 14, Concession IX, Storrington Township

Credit Valley Quarries have operated a small Potsdam

sandstone quarry half a mile east of Battersea on lot 14, concession IX, Storrington township. Three to five feet of thin-bedded grey and brown sandstone is stripped off and the underlying 7 feet of red and grey banded, thin-bedded sandstone in 3 to 6 inch beds is quarried.

Brockville Area

Parks (1912, pp.124-126) describes three sandstone quarries in the Brockville area which are no longer in production. Bolin's quarry is located near Lyn on lot 27, concession II, Elizabethtown township, Leeds county. A quarry measuring 100 by 50 feet has been opened with a 10 foot face. The stone is a white sandstone with a few brown spots. It has been used locally for building and in the Parliament Buildings at Ottawa. Stafford's quarry on lot 26, concession II, Elizabethtown township is in similar stone.

Armstrong's quarry located a mile from Lansdowne station on lot 20, concession II, Lansdowne township, Leeds county exposes 4 feet of stone in beds from 6 to 14 inches thick. Soft white sandstone from this quarry may be seen in the Bennett Block in Gananoque.

Perth - Smiths Falls

Many sandstone quarries have been worked in the Potsdam formation in the Perth - Smiths Falls area and many of the local buildings are built of sandstone.



Bedded Potsdam sandstone at Argo Block quarry.



Thin-bedded Potsdam sandstone at the Battersea quarry.

Hughes Quarry

Lot 26, Concession VII, North Elmsley Township, Lanark County

There are two quarries operated intermittently on the Hughes property in lot 26, concession VII, North Elmsley township, Lanark county. In one opening there is 2 to 4 feet of thin bedded, medium-grained grey and purple mottled Potsdam sandstone. Random flagstone 2 to 3 inches thick is the principal production. A second quarry $\frac{1}{4}$ mile south of the road exposes 3 to 4 feet of medium bedded, even bedded, grey and purple mottled Potsdam sandstone in 8 to 10 inch beds. These beds are used for ashlar building stone. There is some rusty mottling in the sandstone. Describing the stone from this quarry Parks (1912, p.129) says that "the characteristic feature of the colour of this stone is the broad bands of purplish hue which vary from narrow lines to 8 or 10 inches in thickness. Much of the intermediate material is of a yellow colour fading to white. The physical properties of the stone are as follows:

Specific gravity	2.65
Weight per cubic foot, lbs.	150.38
Pore space, percent	8.97
Ratio of absorption, percent	3.72
Crushing strength, lbs. per square inch	15459.
Transverse strength, lbs. per square inch	417."

This stone was used in the post offices in Smiths Falls, Almonte and Arnprior, and in the C.P.R. station at Perth.

Wilson Quarry

Lot 16, Concession I, Bathurst Township

The Wilson quarry near Allan's Mills in lot 16, concession I, Bathurst township is described by Parks (1912, p.131). A large acreage of Potsdam sandstone is available under very little overburden. About 18 inches to 2 feet of stone have been quarried. In one place an upper 9-inch and a lower 8-inch bed were quarried. The stone is white, extremely strong, impermeable and durable. Stone has been quarried on the property as far back as 1827. It has been widely used in Perth.

Ottawa

Potsdam (Nepean) sandstone outcropping near Bells Corners in Nepean township, Carleton county has long been worked as a building stone. The best stone is located on 8 lots on both sides of the concession road; lots 3 to 6, concession I and II, Ottawa Front, Nepean township. Campbell Sandstone Quarries have operated a building stone quarry for many years on lot 3, concession II, Ottawa Front, Nepean township. This area has recently been acquired by the National Capital Commission and further quarry development is unlikely.

On the north side of the road in lot 6, concession I, Ottawa Front, quarries have been developed for several hundred

feet north of the road along the east face of the Potsdam sandstone scarp which rises 15 to 20 feet above the surrounding area. Eight to ten feet of white to rusty, thin to medium bedded Potsdam sandstone are exposed in the quarries. Beds are from 4 to 18 inches in thickness. Vertical joints strike N.60°W. and N.50°E. There is a limited amount of crossbedding. Mudcracks and ripple marks may be observed on bedding surfaces. Bedding is not uniform throughout the quarries. The sandstone appears to be well cemented, in part quartzitic. Joint planes are frequently rusty.

Parks (1912, pp. 134-5) describes Tillson's quarry on lot 6, concession II, Ottawa Front, Nepean township and gives the following physical specifications for the stone:

Specific gravity	2.63
Weight per cubic foot, lbs.	153.50
Pore space, percent	7.22
Ratio of absorption, percent	2.93
Crushing strength, lbs. per square inch	22032.
Transverse strength, lbs. per square inch	1620.

Parks reports that stone from the Tillson quarry was used in construction of the Museum, Mint and Observatory in Ottawa.

MEDINA SANDSTONE

The Medina sandstone outcrops along the base of the Niagara escarpment from Niagara Falls to Collingwood. The Whirlpool

sandstone member of the Medina group, known to driller's as the "White Medina", is a massive to thick bedded, white grey or red fine-grained crossbedded sandstone. Red mottled zones occur near Merritton and Inglewood, and deep chocolate red sandstone occurs in the formation near Terra Cotta and Credit Forks. The Whirlpool sandstone rests unconformably on the Queenston shale and is overlain either by the Power Glen shale in the Niagara-Stoney Creek area or the Manitoulin limestone from Stoney Creek northward. The sandstone varies in thickness from 18 to 28 feet at Niagara Falls, 12 feet at De Cew Falls and Hamilton, 15 feet at Belfountain and Cataract, to 6 feet at Duntroon (Bolton 1957, p.10).

The Whirlpool sandstone member of the Medina (Cataract) group is the only Medina sandstone unit being quarried in Ontario. It is quarried for building stone at Limehouse, Glen Williams, Terra Cotta and Inglewood, and as a source of silica at Milton.

In 1962 nineteen sandstone quarries were operating in the Limehouse-Inglewood area as follows:

Limehouse:

- Scott quarry, Lot 17, Con. V, Esquesing Twp., Halton county.
- Inglewood Quarries Limited, Lot 19, Con. V, Esquesing Twp.
- Rice & McHarg quarry, Lot 21, Con. V, Esquesing Twp.
- Cphoon quarry, Lot 22, Con. V, Esquesing Twp.
- Skelin quarry, Lot 20, Con. VI, Esquesing Twp.

Glen Williams:

Structural Sandstone quarry, Lot 26, Con. IX, Esquesing
Twp., Halton County.

Hilltop quarry, Argo Block Co., Lot 26, Con. X, Esquesing
Twp.

Austin Corners quarry, Lot 27, Con. X, Esquesing Twp.

Ed Martin quarry, Lot 28, Con. X, Esquesing Twp.

Terra Cotta:

Smithson quarry, W $\frac{1}{2}$, Lot 30, Con. VI, Chinguacousy Twp.,
Peel county.

Zilio quarry, E $\frac{1}{2}$, Lot 30, Con. VI, Chinguacousy Twp.

Inglewood:

Norrie quarry,)
Walker Bros. quarry,) Lots 1 & 2, Con. III W,
Wilson quarries,) Caledon Twp., Peel county.
Garvin & Logan quarry,)

McAlpine quarry, Lot 3, Con. III W, Caledon Twp.,
Peel county.

De Forest Bros. quarry, Lot 4, Con. III W, Caledon Twp.

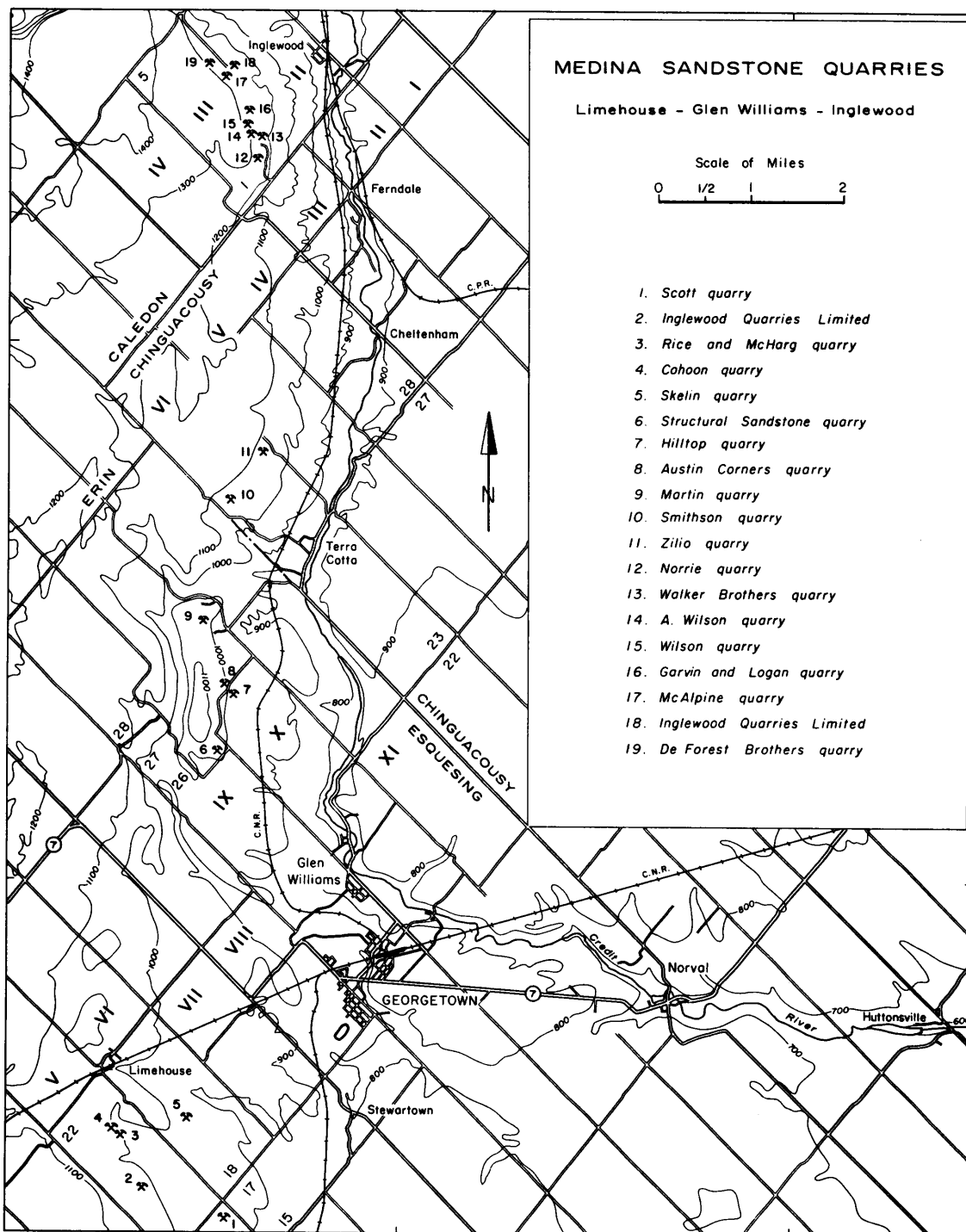
Inglewood Quarries Limited, Lot 3 or 4, Con. II W,
Caledon Twp.

Limehouse

Scott Quarry

Lot 17, Concession V, Esquesing Township

The Scott quarry was opened in 1958 on lot 17,



concession V, Esquesing township, 2 miles southeast of Limehouse. The quarry is 100 feet west of the concession road. Six to 10 feet of clay overburden is stripped. Six feet of medium to thick bedded grey to reddish fine-grained Medina sandstone is exposed in the quarry which has a face over 100 feet long trending north-south. Beds range from 3 to 36 inches thick and are mainly over 8 inches thick. Joints are somewhat irregular. Some crossbedding is present in the northeast corner of the quarry. The stone has good reed and splits well. Holes 5 inches deep are drilled in line to split the heavier beds with plug and feathers. Equipment consists of a compressor and drills, a fork lift truck and bulldozer. Production is mainly dry wall stone, ashlar, and flagstone.

Inglewood Quarries Limited

Lot 19, Concession V, Esquesing Township

Inglewood Quarries Limited operated by Ross Brothers have a quarry on the farm of Harold Brown on lot 19, concession V, Esquesing township, 2 miles south of Limehouse. There are two quarry openings 300 feet apart. Six to 10 feet of clay overburden is stripped off. Seven to nine feet of grey and buff, fine-grained, medium bedded, irregularly bedded Medina sandstone is exposed in the quarry. Due to irregular bedding and crossbedding much of the stone is not free splitting and from 5 to 6 feet of top rock suitable for wall stone and rubble

Weight per cubic foot, 145 pounds;

Abrasive hardness, 14.8.

Cohoon Quarry

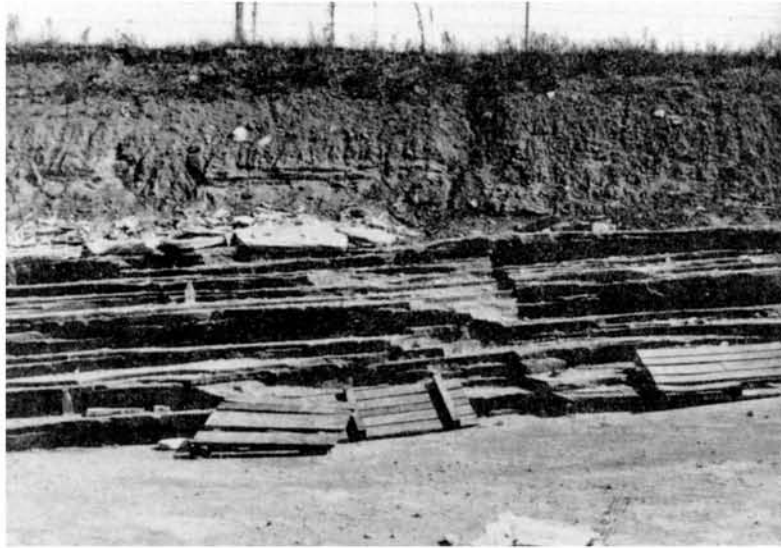
Lot 22, Concession V, Esquesing Township

Immediately adjacent to the Rice and McHarg quarry on the north lies the Cohoon quarry operated by C. Sheppard. The depth of overburden and rock section is similar to that in the Rice & McHarg quarry.

Skelin Quarry

Lot 20, Concession VI, Esquesing Township

A quarry has been opened on lot 20, concession VI, Esquesing township in 1962 by Steve Skelin. There is 9 to 10 feet of clay till overburden to be stripped exposing 7 to 8 feet of grey, fine-grained, medium to thick bedded Medina sandstone. The upper 2 to 3 feet of heavy bedded sandstone is stripped off. The lower 5 feet of stone is regular bedded, medium to thin bedded, with beds 2 to 9 inches thick. The stone has good reed. Queenston shale forms the quarry floor in places. The 5-foot working face has a length of 80 feet. Vertical joints strike N.W. A compressor and drills are used to drill the stone which is split with plugs and feathers. Main production is ashlar, flagstone, steps and copings.



Thin-bedded Medina sandstone at Rice & McHarg quarry, Limehouse.



Trimming flagstone at Rice & McHarg quarry, Limehouse.

Glen Williams

Structural Sandstone Quarry

Lot 26, Concession IX, Esquesing Township

The Structural Sandstone quarry is located on lot 26, concession IX, Esquesing township on the property formerly operated by Industrial Sand and Gravel. The quarry opening measures 50 by 100 feet and a considerable thickness of clay and shaly limestone is stripped to reach the stone beds. The section observed at the quarry consists of 2 feet of green shale and limestone underlain by 3.6 feet of buff sandstone in 6 to 8-inch beds with shaly partings, followed by 4.5 feet of crossbedded sandstone, 6 inches of buff sandstone and 3 to 5 feet of good grey coursing stone with good splitting qualities. This is underlain by a 10-inch sandstone bed and shale. The 3 to 5 foot section of stone with good reed yields the main production of building stone. Equipment includes compressor, drills, fork-lift truck, plug and feathers, hammers, sledges, wedges and chisels.

Core drilling indicates approximately 20 feet of grey sandstone underlying the quarry property. It is reported that this stone was used at the University of Western Ontario and in Casa Loma.

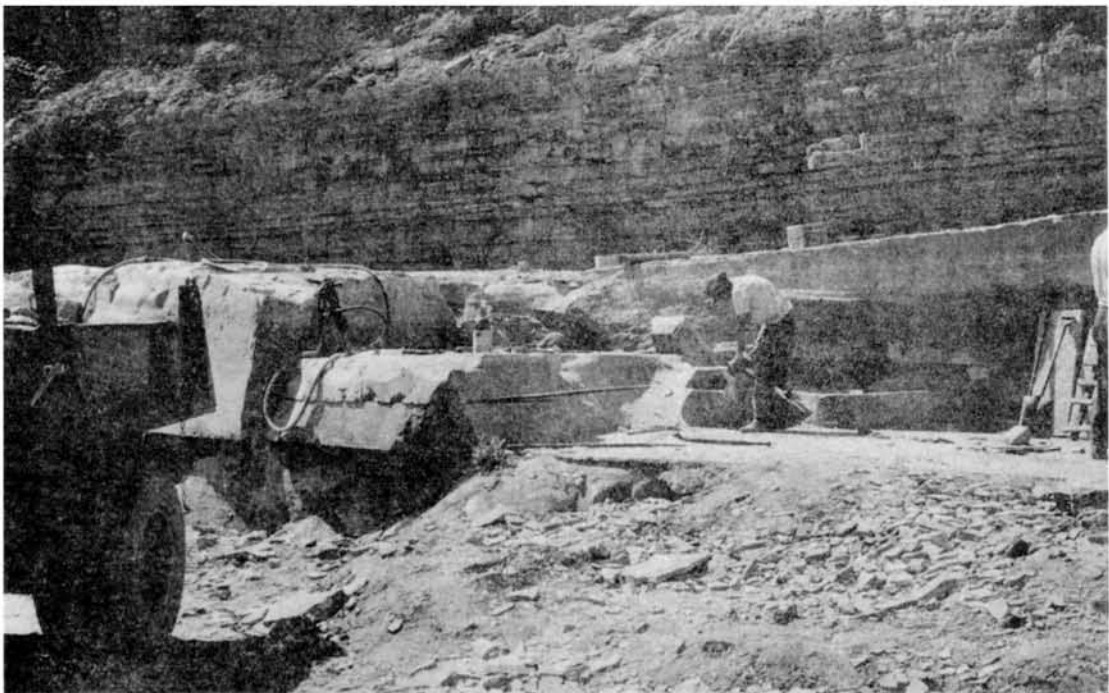
Hilltop Quarry, Primeau Argo Block Company

Lot 26, Concession X, Esquesing Township

The largest sandstone quarry in Ontario is the Hilltop



Fork lift truck used to lift blocks of sandstone at Structural Sandstone quarry, Glen Williams.



Medina sandstone ledge at Norrie quarry, Inglewood.

quarry of Primeau Argo Block Company on the southeast side of the road on lot 26, concession X, Esquesing township. The sandstone section which outcrops along the edge of a large elongated outlier of Amabel dolomite, has been opened for over a quarter of a mile along the hillside in a north-south direction. As the sandstone face is advanced to the northwest up to 25 feet of limestone, shale, sandstone and clay overburden must be stripped.

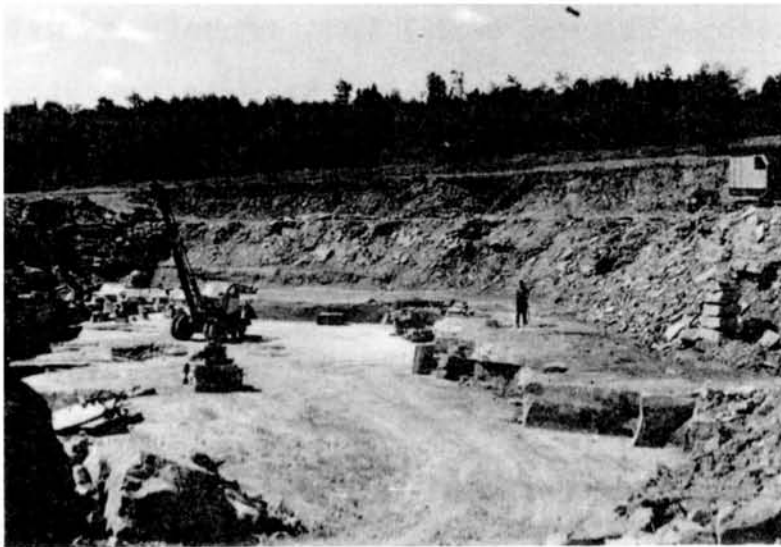
The northwest face of the quarry now being operated exposes 12.5 feet of medium to thick bedded, fine-grained grey Medina Sandstone. The beds being quarried have the following thicknesses from the top down: 4.3 feet, 1.2 feet, 0.7 feet, 2.3 feet and 4.0 feet. The southwest quarry face exposes 8.5 feet of sandstone. To remove large mill blocks for sawing, one inch holes are drilled completely through the beds on 0.8 foot centres. The stone is mainly grey with some reddish bands. Crossbedding is uncommon. Mill blocks, ashlar, flagstone, sills, steps and coping are produced. Mill blocks are sawn at the Cooksville plant of Primeau Argo Block Company. Blocks are handled by a crane. Equipment includes compressors and drills, guillotine, wedges, plugs and feathers.

Physical properties of specimens of grey Medina sandstone (No.75) from this quarry are as follows:

Compressive strength, p.s.i., maximum: 17500;
minimum: 12650;
average: 15433;



Hilltop quarry of Primeau Argo Block Limited at Glen Williams.



Corner's sandstone quarry, Glen Williams.

Absorption, 2.81 percent;
Bulk specific gravity, 2.34;
Weight per cubic foot, 146 pounds;
Abrasive hardness, 12.5.

Austin Corner's Quarry

Lot 27, Concession X, Esquesing Township

In 1962 a quarry was opened on lot 27, concession X, Esquesing township across the road from the Hilltop quarry. Approximately 10 feet of clay overburden and 13 feet of dolomite and shale must be stripped to expose the stone beds. The stone face quarried consists of 8.7 feet of thick to massive bedded, fine-grained, buff, grey and red mottled Medina sandstone. The upper 3.7 feet of buff sandstone is quarried in two beds and these are the main freestone coursing beds. The lower 5 feet is red and grey mottled and streaked sandstone in which bedding intervals are somewhat variable across the quarry.

Equipment consists of compressor and drills, portable crane, wedges, plug and feathers, etc. Ashlar, flagstone, copings and steps are produced.

Physical properties of a specimen of grey Medina sandstone (No.77) from this quarry are as follows:

Compressive strength, p.s.i., maximum: 15075;
minimum: 9950;
average: 10842;

Absorption, 3.11 percent;
Bulk specific gravity, 2.33;
Weight per cubic foot, 145 pounds;
Abrasive hardness, 15.7.

Martin Quarry

Lot 28, Concession X, Esquesing Township

The sandstone quarry operated by Ed Martin is located at the north end of the Hilltop outlier on lot 28, concession X, Esquesing township. This quarry has operated for many years and the main workings form a cut over 300 feet long and 80 feet wide. Five to six feet of medium bedded, grey and red mottled fine-grained Medina sandstone is quarried. Irregular bedding makes quarrying difficult in places and much of the good stone has been removed. Six to eight feet of shaly limestone overburden is stripped to expose the sandstone. A "knurl" or crossbedded section of stone cuts diagonally through the quarry.

Coursing, sills, steps, flagstone and rubble are the main products.

Terra Cotta

Smithson Quarry

West Half, Lot 30, Concession VI, Chinguacousy Township

The Smithson quarry is located on the west half of lot 30, concession VI, Chinguacousy township, about a mile northwest

AMENDMENT

Please insert the enclosed amendment on page 31 of Industrial Mineral Report No. 17, Building Stones of Ontario, Part IV, Sandstone, to replace the description of the Martin quarry.

Martin Quarry

Lot 28, Concession X, Esquesing township

The sandstone quarry operated by Edward Martin is located at the north end of the Hilltop outlier on lot 28, concession X, Esquesing township. The property consists of 200 acres mainly underlain by the sandstone formation. This quarry has operated since 1929 and the main workings form a cut over 600 feet long and 80 feet wide. Five to six feet of medium bedded, grey and red mottled fine-grained Medina sandstone is quarried. Some irregular bedding and crossbedding is present, but much good stone is available. Six to eight feet of shaly limestone overburden is stripped to expose the sandstone.

Coursing, sills, steps, flagstone and rubble are the main products.

of Terra Cotta. Five to six feet of thin to medium bedded, fine-grained, grey and red Medina sandstone is exposed in the quarry. Exposures are poor as most of the quarry is water-filled. Bedding is irregular.

Zilio Quarry

East Half, Lot 30, Concession VI, Chinguacousy Township

A small quarry on the east half of lot 30, concession VI, Chinguacousy township, a mile northwest of Terra Cotta is operated by A. Zilio for Credit Valley Quarries. There is little or no overburden on the sandstone. An area of 100 by 350 feet has been stripped exposing about 4 feet of thin bedded, red and grey, fine-grained Medina sandstone. Bedding is somewhat irregular and much 2-inch random flagstone is produced from thin layers. Vertical joints strike N.-S. and E.-W. Little coursing stone is produced.

Inglewood

A group of eight small sandstone quarries are being operated along the edge of the escarpment west of Inglewood on lots 1 to 4, concession III W, Caledon township. A group of quarries were formerly operated a mile to the northwest near Credit Forks but these quarries are now abandoned.

The five southern quarries are located on lots 1 and 2, concession III W and are reached from the Chinguacousy-Caledon

township line. These quarries are on properties owned by Credit Valley Quarries, D. Davidson and the University of Toronto. Quarry operators pay a royalty to the owners.

Norrie Quarry

Lots 1 and 2, Concession III West, Caledon Township

The most southerly quarry of this group of quarries is operated by Steve Norrie. The quarry face has been advanced toward the escarpment and overburden is now a serious problem which will soon limit quarrying to the west. About 25 feet of dolomite and shale overlie the sandstone beds. The stone quarried is an 8-foot section of massive grey fine-grained Medina sandstone with good splitting qualities. Equipment consists of a compressor, drills, sledge hammers, wedges, plug and feathers and chisels. Large blocks are split off by drilling a series of holes parallel to the quarry face and using black powder. The stone is split horizontally by plug and feathers used in short horizontal drill holes. Production is mainly ashlar, flagstone, steps, coping, dry wall stone and rubble.

Physical properties of a specimen of grey Medina sandstone (No.78) from this quarry are as follows:

Compressive strength, p.s.i., maximum: 16700;

minimum: 11000;

average: 13850;

Absorption, 3.01 percent;

Bulk specific gravity, 2.33;

Weight per cubic foot, 145 pounds;

Abrasive hardness, 9.3.

Walker Brothers Quarry

Lot 2, Concession III West, Caledon Township

Walker Brothers are quarrying up to 2 feet of fine-grained, medium bedded, grey to red Medina sandstone to the north of Norrie's quarry. The area being worked is on the flats a few hundred feet east of the escarpment, and has been completely stripped of overburden.

Physical properties of a specimen of grey Medina sandstone (No.73) from this quarry are as follows:

Compressive strength, p.s.i., maximum: 12525;
minimum: 9050;
average: 11150;

Absorption, 2.20 percent;

Bulk specific gravity, 2.38;

Weight per cubic foot, 148 pounds;

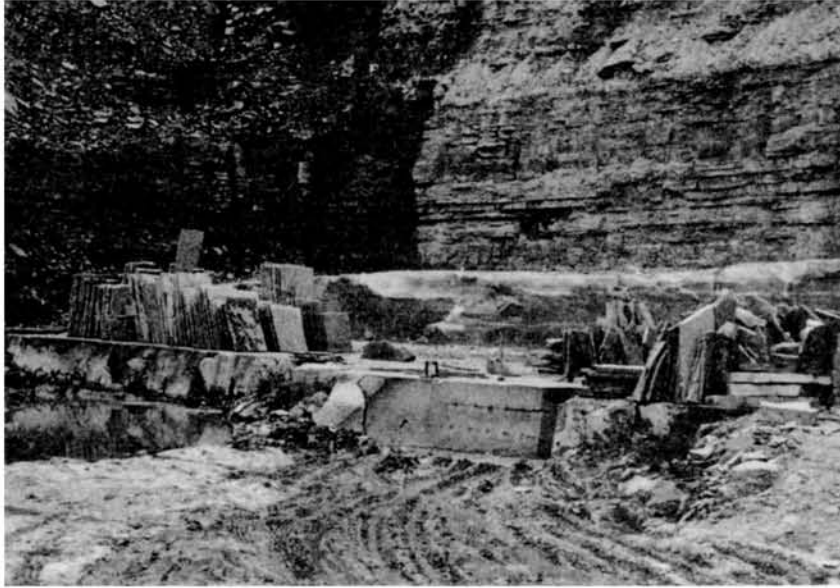
Abrasive hardness, 18.3.

Physical properties of a specimen of red Medina sandstone (No.74) from this quarry are as follows:

Compressive strength, p.s.i., maximum: 18500;
minimum: 10875;
average: 15000;

Absorption, 3.05 percent;

Bulk specific gravity, 2.32;



Medina sandstone ledge at Norrie quarry, Inglewood.



Wilson quarry, Inglewood.

Weight per cubic foot, 145 pounds;

Abrasive hardness, 7.3.

Allan Wilson Quarry

Lot 2, Concession III West, Caledon Township

The quarry operated by Allan Wilson is at the edge of the escarpment west of Walker Brothers quarry on lot 2, concession III W., Caledon township. The 12-foot section of medium to thick bedded, grey to red, fine-grained Medina sandstone has been worked westward to the face of the escarpment and the stone is now overlain by 30 feet of dolomite and shale which precludes development of the stone to the west. The beds being quarried in sequence from the top down are 0.6 feet of grey, 1.2 feet of grey, 5.1 feet of reddish, 1.4 feet of red, 0.8 feet of red and grey, 1.2 feet of red and grey and 1.3 feet of red and grey with good reed. Ashlar, flagstone, steps, coping and rubble is produced.

In 1963 Smithson's quarry was opened along strike to the south of Allan Wilson's quarry. The rock section is similar to that at Wilson's quarry.

Wilson Quarry

Lot 2, Concession III West, Caledon Township

Immediately north of Allan Wilson's quarry a quarry is operated by Elmer Wilson. A six foot section of red and

grey, medium to thick bedded, fine grained Medina sandstone is quarried. The upper beds are grey and the lower red. The present opening is 20 by 60 feet.

Garvin and Logan Quarry

Lot 2, Concession III West, Caledon Township

The most northerly of the five quarries is operated by Garvin and Logan. There are approximately 4 feet of thin-bedded red and grey, fine-grained Medina sandstone. Flagstone is the principal production.

The three northern quarries are located on lots 3 and 4, concession II and III West, Caledon township and are reached from the next road to the north.

McAlpine Quarry

Lot 3, Concession III West, Caledon Township

The McAlpine quarry which is about one-quarter mile north of Garvin and Logan's quarry exposes 3 to 4 feet of thin bedded, grey, fine-grained Medina sandstone. There is 3 to 4 feet of stripping. Flagstone, steps and copings are the principal products.

Inglewood Quarries Limited

Lot 3 or 4, Concession II West, Caledon Township

East of McAlpine's quarry is a quarry operated by Ross

Brothers operating under the name of Inglewood Quarries Limited. There is a 4-foot section of red and grey, fine-grained, thin to medium bedded Medina sandstone.

De Forest Brothers Quarry

Lot 4, Concession III West, Caledon Township

The most northerly quarry in lot 4, concession III W., Caledon township, is operated by De Forest brothers. Six to 10 feet of shaly limestone is stripped off. An 8-foot section of medium to thin-bedded, grey and red, fine-grained Medina sandstone is quarried to produce flagstone and coursing stone.

INACTIVE MEDINA SANDSTONE QUARRIES

Medina sandstone has been quarried elsewhere along the base of the escarpment at Merritton, Rockway, Jordan, Grimsby, Hamilton, Waterdown, Milton, Orangeville and Duntroon.

Merritton

Parks (1912, p.140) describes quarrying of the Medina sandstone along the tracks of the Niagara Central railway north of Merritton. A cliff about 20 feet high extended for a half mile and much mottled red and grey Medina sandstone was quarried from this locality.

Rockway

Parks (1912, p.141) describes the Goodall quarry at Rockway, on lot 10, concession VII, Louth township, Lincoln county. About 6 feet of red and grey mottled Medina sandstone are exposed in a quarry about 150 feet long. Beds are 7 to 14 inches thick. This stone was used for a Roman Catholic church in Niagara Falls and a paper mill at St. Catherines.

Jordan

Two quarry properties are described by Parks (1912, p.142) at Jordan. William Biggar's quarry was located on lot 15, concession VI, Louth township, Lincoln county. About 10 feet of mottled Medina sandstone in beds 4 inches to 1 foot thick are exposed in the quarry. Overburden is thick. The second quarry is on Daniel Thompson's property, lot 14, concession VI, Louth township. Grey Medina sandstone in beds up to 2 feet thick are exposed in the sides of a ravine 30 feet deep. The stone is marred by brown spots and Parks found it impossible to estimate the thickness of stone.

Hamilton

G.F. Webb formerly operated a Medina sandstone quarry at the head of Victoria Avenue in Hamilton. From 8 to 9 feet of grey sandstone was quarried. Overburden is quite thick.

George Mills operated a quarry on the mountain side east of the head of Emerald Street. Parks (1912, p.144) reports that there was 8 feet of grey sandstone in thick beds. The lower 5 feet were quarried for building stone. Overburden is thick.

Waterdown

William R. Barnes formerly operated a Medina sandstone quarry on lot 5 or 6, concession II, East Flamborough township, Wentworth county on the side of the escarpment just east of the Aldershot-Waterdown road. The quarry opening measures 120 by 60 feet with an 8 foot face of grey Medina sandstone in beds from 2 inches to 3 feet in thickness. Extremely irregular crossbedding makes it unsuitable for coursing stone but some flagstone was produced.

Milton

William R. Barnes Company operates a quarry in Medina sandstone on lot 6, concession VI, Nassagaweya township, Halton county, for the production of silica grit and ganister. A 6- to 10-foot section of fine-grained, medium-bedded grey Medina sandstone is exposed in the quarry. It is overlain by Manitoulin limestone and Cabot Head shale to a depth of up to 10 feet. An analysis of the silica sand produced by crushing this sandstone was carried out by the Laboratory Branch, Ontario Department of Mines with the following results:

	Percent
SiO ₂	93.80
Al ₂ O ₃	1.21
Fe ₂ O ₃	0.09
MgO	0.11
CaO	1.90
K ₂ O	0.08
TiO ₂	0.04
L.O.I.	1.78
	<hr/>
Total	99.01

The Timbers sandstone quarry described by Parks (1912, p.145) was situated 2 miles west of Milton directly behind the second brickyard on the line of the C.P.R. toward Campbellville. Twelve feet of irregularly bedded grey Medina sandstone are exposed in a quarry measuring 50 by 200 feet. A one hundred to three hundred foot width of sandstone is available along the escarpment edge before the sandstone passes under the limestone and shale overburden. The stone has brown spots.

To the west of Timbers quarry are the quarries of Campbell Pollock and D. Robertson and Company. In the Robertson quarries which were opened on both sides of the railroad, 12 feet of grey Medina sandstone in 8-inch to 3-foot beds were quarried. Bedding is said to be very irregular. Most of the production was rubble stone. A church and the court house in Milton are built of this stone.

Orangeville

Medina sandstone was formerly quarried by Geo. Nicholson on lot 6, concession T, Mono West township, Dufferin county about three miles northeast of Orangeville. Parks (1912, p.159) describes 10 feet of grey, fine-grained Medina sandstone in beds from 15 inches to 5 feet in thickness. Parks states that "under the microscope the rock is seen to be composed chiefly of quartz grains which are not more than one-eighth of a mm. in diameter. In addition to quartz there are a few grains of feldspar in a more or less decomposed condition. The quartz particles are mostly angular in outline and fitted close together, but the feldspar individuals are more rounded in outline. The cement, according to Wait, is carbonate of lime, with a little argillaceous matter; it is not present to any great extent..... The physical characteristics are as follows:

Specific gravity	2.66
Weight per cubic foot, lbs.	141.06
Pore space, percent	14.87
Ratio of absorption, percent	6.59
Crushing strength, lbs. per square inch	12590.
Transverse strength, lbs. per square inch	568."

Owen Sound Stone Company operated a quarry on lots 6 and 7, concession I, Mono East township, Dufferin county. About 14 feet of sandstone is present in three beds. Overburden is thick. These quarries produced stone for the Toronto city hall.

Duntroon

In 1961 a Medina sandstone quarry was operated by Angelstone Limited a mile and a quarter west of Duntroon in lot 24, concession XI, Nottawasaga township, Simcoe county. The quarry opening is 200 feet long south of the road along the east edge of a low scarp just west of the crossroads. Six feet of grey, medium- to fine-grained, thick bedded sandstone is exposed. The bedding is not regular throughout the quarry and there is some crossbedding. At the north end of the quarry beds are 2.2 feet, 2.1 feet, 1.0 feet and 0.9 feet thick. There are some shaly partings. The sandstone is overlain by 8 to 10 feet of thin bedded dolomite and shaly dolomite which must be stripped off. This stone was used for the Lawson Library at the University of Western Ontario.

ORISKANY SANDSTONE

A small area of Oriskany sandstone outcrops in Oneida and North Cayuga townships, Haldimand county, four miles west of Cayuga. The sandstone has a maximum thickness of 20 feet and thins to the southeast and northwest. It is underlain by Bertie - Akron dolomite and overlain by cherty Bois Blanc limestone.

Parks (1912, p.165) has described a quarry operated by H.D. MacDonald in the southwestern part of lot 47, concession I,

Oneida township. The quarry face is 12 feet high. The sandstone is white, medium-grained and thick bedded, and has the following physical specifications.

Specific gravity	2.66
Weight per cubic foot, lbs.	154.95
Pore space, percent	6.55
Ratio of absorption, percent	2.64
Coefficient of saturation	0.28
Crushing strength, lbs. per square inch	17949.
Transverse strength, lbs. per square inch	2186.

The stone may be seen in the Presbyterian churches at Clanbrassil and Cayuga, the Methodist church at Balmoral and the English church at Cayuga.

In the 1950's some building stone was removed from quarries on lot 48, concession I, and lot 49, concession I, Oneida township.

ROOT RIVER SANDSTONE

The Root River or Lake Superior sandstone outcrops in the vicinity of Sault Ste. Marie where many of the building excavations are in this stone. The canal and locks at the Soo were excavated from this sandstone and the stone was used in many local buildings including the Algoma Central station. It is an attractive red and buff mottled, medium-grained, medium-bedded sandstone. Small quarries have been opened up

at Root River near the Algoma Central railway crossing, but these have been idle for several years.

SIBLEY SANDSTONE

The Sibley sandstone in the Thunder Cape area has been used for building stone. The occurrences are described by Tanton (1931, p.199) as follows: "Sandstone suitable for building material occurs in the Sibley series in Thunder Cape map-area. A pale grey, impure, quartz sandstone has been produced from a quarry about a mile northerly from George point on the east shore of Black Bay. There has been no production in recent years."

"It is reported that the greater part of the eastern shore of Thunder Bay was taken up, many years ago, as quarry locations. White quartz sandstone is there prominently exposed in cliffs about 200 feet high. A small amount of this material was produced from a quarry on the shore east of Keshkabuon (Caribou) Island, at a place about 2 miles north of Thunder Cape map-area, on mining location V18, Sibley."

"The principal production of sandstone from the Sibley series has come from quarries north and northeast of Thunder Cape map-area at the following localities: Simpson Island and Isle Verte in Nipigon Bay; and lot 2, concession VI, Stirling township. The last-mentioned quarry has been worked in recent years; it is owned by Messrs. W.A. Dowler and M. Watty, Hurkett, Ontario; from it is produced an impure quartz sandstone, almost white

and with a delicate pinkish tint."

SLATE

A total of 938 tons of slate valued at \$8,056 has been produced in Ontario. This came from the Madoc area during the years 1932 to 1937. Companies which were active in the area included Ontario Slate Mines Limited on lot 5, concessions V and VI, Madoc township, Canadian Slate Products Limited, Crespey Slate Products Limited and Canada Slate Products Limited.

A band of slate several hundred feet wide forms a synclinal fold that extends from lot 2, concession V, Madoc township at No. 7 highway to lot 5, concession VI on highway No. 62. A small slate quarry opened on lot 5, concession VI exposes a 15-foot face of dark grey slate interbedded with slaty conglomerate beds up to 3 feet thick. The bedding strikes N.25°E. and dips 40°E. Prominent slaty cleavage strikes N.60°E. and dips 70°S. A vertical joint system strikes east-west. Some fine-grained garnet schist is interbedded with the slate. The slaty cleavage is not perfect and the slate does not split well into uniform sheets.

A second small slate quarry has been opened on lot 2, concession V, Madoc township. The slate is dark grey and fine-grained with silver-grey spots which weather out. Strongly developed vertical slaty cleavage strikes N.60°E. Bedding swings from north-south to east-west and the quarry appears to be in the trough of a syncline.

PRECAST CONCRETE AGGREGATE

Rock chips and pebbles of varied colours are now widely used to face precast concrete panels which are used as a substitute for dimension stone in facing buildings.

Producers of aggregate for precast concrete panels will produce chip sizes to consumers' requirements. There appears to be no standardization of sizes in the industry as yet. One producer has the following size range:

Size 0:	10 to 16 mesh
Size 1:	4 to 10 mesh
Size 2:	3/8" to 4 mesh
Size 3:	5/8" to 3/8"
Size 4:	1 1/4" to 5/8"

A second producer has the following size ranges:

1 1/2" - 3/4"
3/4" - 1/2"
1/2" - 3/8"
3/8" - 1/4"
1/4" - 1/8"
1/8" - 1/16"
1/16" - 30 mesh
Minus 30 mesh

The following size ranges are standard for marble chips:

Size 0:	1/8" - 1/16"
Size 1:	1/4" - 1/8"
Size 2:	3/8" - 1/4"
Size 3:	1/2" - 3/8"
Size 4:	5/8" - 1/2"
Size 5:	3/4" - 5/8"
Size 6:	7/8" - 3/4"
Size 7:	1" - 7/8"
Size 8:	1 1/8" - 1"

Combinations of these sizes are generally used.

Prices range from \$18 to \$40 per ton f.o.b. mill depending on the size, colour and quality of the aggregate. Chips are generally granite, syenite, feldspar, quartz, gabbro, basalt and similar hard rock types, but marble chips are also used.

The following companies produced chips for precast concrete aggregate in Ontario in 1962:

Hard Rock Chips

Rideau Aggregate Company,	Verona, Ontario.
Industrial Garnet Company,	River Valley, Ontario.
William R. Barnes Company,	Waterdown, Ontario.
Minnesota Minerals Limited,	Havelock, Ontario.

Marble Chips

Stoklosar Marble Quarries Limited, Madoc, Ontario.

Hastings Marble Products Limited,	Madoc, Ontario.
Madoc Marble Quarries Limited,	Madoc, Ontario.
Canada Talc Industries, Limited,	Madoc, Ontario.
Bolenders Limited,	Eagle Lake, Ontario.
Rideau Aggregate Company,	Verona, Ontario.

Rideau Aggregate Company produces 6 varieties of hard rock chips: white quartz, red feldspar, pink granite, red granite, brown granite and black granite, and two varieties of white marble from the Verona area in Eastern Ontario.

Industrial Garnet Company produces seven varieties of hard rock chips: two varieties of black granite, and a grey granite from Gibbons township; red granite, pink feldspar and translucent quartz from Ratter township; and opaque quartz from Janes township in the River Valley area of northern Ontario.

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