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RECONNAISSANCE OF EXTRACTIVE RESOURCES IN THE GATTON AND LAIDLEY SHIRES

by

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SUMMARY

Significant resources of construction materials in the Gatton Shire are limited to small deposits of basalt and ironstone gravel. The Laidley Shire has no significant resources of construction materials.

There are few potential sources for crushed rock because of widespread soft sedimentary rocks and deeply weathered basalts. Only rare basaltic plugs offer some potential for hard-rock quarries. Lateritic gravels in the north of the Gatton Shire provide road base and maintenance gravels.

Suitable deposits of sand and gravel are few and small, and are limited to the alluvium of Lockyer Creek between Grantham and Helidon. Subeconomic deposits of sand and gravel occur in Laidley Creek south of Mulgowie.

Clay is not currently worked in the two shires and deposits of suitable ceramic materials have not been located.

Building stone (sandstone) is produced from quarries near Helidon and reserves are large.

A large deposit of diatomite is quarried near Black Duck Creek in the southern part of the Gatton Shire. Other minerals of significance do not occur.

INTRODUCTION

There is an ever present demand for conveniently located deposits of industrial rocks and minerals to supply the needs of developing communities. To ensure an adequate supply of these materials in the long term, deposits need to be protected for future use.

This report is the result of a reconnaissance survey that was carried out to show all known workings and potential deposits of rocks and minerals in the Gatton and Laidley Shires to assist the respective Shire Councils in land-use planning.

Individual potential deposits have not been evaluated in detail, and further investigations will be necessary to confirm the suitability and extent of material reserves.

PREVIOUS INVESTIGATIONS

A variety of geological, hydrogeological, and land suitability studies have been carried out in the Lockyer Valley, which encompasses the Gatton and Laidley Shires.

McTaggart (1963) described the Mesozoic sequence of the area in detail. Geological mapping of the Ipswich and Brisbane 1:250 000 Sheet areas was carried out by the Geological Survey (Cranfield & others, 1976). The Department of Primary Industries (1974) assessed the non-urban land suitability during a study of the Moreton Region and has recently completed a land suitability and degradation study of the catchment area of Lockyer Creek. A summary of the Queensland building and monumental stone industries including those in the Helidon area, was provided by Wolff (1957). The diatomite deposits in the Black Duck Creek area were described by Ball (1927) and Bonner (1951). The Irrigation and Water Supply Commission (1965, 1966) carried out hydrogeological investigations of the alluvium in the Lockyer Valley. Zahawi (1975) investigated the groundwater potential of some of the rock units in the area.

METHOD OF INVESTIGATION

To obtain a geological base map of the two shires, the geological maps at 1:50 000 prepared for the hydrogeological investigation of the area (Zahawi, 1975) were reduced to 1:100 000. This was followed by air-photo interpretation and by inspections of the workings in the area.

A programme of auger drilling, consisting of 29 holes in the Gatton Shire and 25 holes in the Laidley Shire, was carried out with a Proline drill to test the potential for sand, gravel and clay in selected areas. An attempt was made to drill each hole to a maximum depth of 10 m below the surface. However, a number of holes were terminated at shallower depths because of the presence of impenetrable cobbles or hard sandstone. Two diamond drillholes were sunk by a Mindrill F20 drill on a potential quarry-rock site, each to a depth of 25 m. All drilling was carried out by the Drilling Branch of the Department of Mines.

Sieve analyses were carried out on 11 sand samples by the Geological Survey of Queensland. Forty-six clay samples were tested by the Government Chemical Laboratory to determine their suitability for ceramic use. During this testing, the clays were air-dried and fired in an electric furnace under slightly oxidising conditions at temperatures ranging from 900°C to 1200°C. The test results list drying and firing shrinkage, colour, strength, and the degree of sinter together with comments on the suitability of the tested material.

PRESENTATION OF RESULTS

The locations of major workings of quarry rock, building stone, sand, gravel and loam are shown on the accompanying 1:100 000 maps (Plates 1 and 2), indexed by abbreviated Australian Map Grid co-ordinates. Brief notes on the workings are tabulated, and the more significant operations are also described in the text. The information is up to date as at June 1978.

Potential deposits of quarry-rock, sand, gravel and clay are outlined on Plates 1 and 2 in two categories: (i) significant sources and (ii) minor or possible sources. These categories correspond to quality, reserves, and the level of available information.

The level at which the investigation was carried out precludes any estimation of reserves. The terms large, moderate, and small have been used to indicate the magnitude of reserves, and refer to working lives of more than a decade, a few to 10 years or a few years only at current production rates.

The basic data resulting from drilling and testing (drill hole locations, drill logs, clay firing test results, sieve analyses) are available at the Geological Survey of Queensland.

ACKNOWLEDGEMENTS

The assistance of the Gatton and Laidley Shire Councils in providing data relating to workings is gratefully acknowledged. Thanks are also due to Mr B. Kilmister, Gatton Shire Engineer, for making available a backhoe to test some

deposits. Mr C.R.J. Bolton, Cadet (Geology), assisted in the sampling and logging of auger holes, and Mr B.J. Neville, Geological Foreman, carried out the sieve analyses.

REGIONAL GEOLOGY AND ITS SIGNIFICANCE

The following discussion outlines the general locations and rock types of the geological units, and indicates their significance for the extractive industries.

A summary of the geological units is shown in Table 1, and has been modified from Cranfield and others (1976) and Zahawi (1975).

PALAEOZOIC

Cressbrook Creek Group (Pc)

The Permian Cressbrook Creek Group, which crops out only in the northern part of the Gatton Shire, includes the Biarraville Formation, the Box Gully Formation, and the Buaraba Mudstone, and an undifferentiated unit.

Biarraville Formation (Pcr)

This unit is about 45 m thick and consists of chert, hard sandstone, siltstone, and mudstone. It also includes sedimentary breccia, rhyolite, crinoidal limestone, and coarse-grained andesitic conglomerate.

The unit crops out in a small area to the east of Mount Cross. The rocks in the area are generally weathered and have little potential for the extractive industry.

Box Gully Formation (Pcg)

This unit crops out to the east of Mount Cross and consists largely of sandy conglomerate and sandstone. The sandstone is black to grey, fine-grained, non-calcareous, and carbonaceous in places. Some minor shale and andesite are interbedded with sandstone.

This unit forms rugged topography with steep slopes strewn with boulders. The sandstone has little potential for building stone because of difficulty of access and the availability of more suitable material elsewhere.

Table 1 : Geological Units of Gatton and Laidley Shires

Age		Geological formation and letter symbol		Main rock types
CAINOZOIC	QUATERNARY	Alluvium (Qz)		Gravel, sand, silt
		Colluvium (Qx)		Gravel, sand, silt
		Lacustrine deposits (Cza)		Organic clay
	TERTIARY	Volcanic plugs (Tv)		Basalt
		Main Range Volcanics (Tm)		Basalt, minor trachyte
MESOZOIC	JURASSIC	Walloon Coal Measures (Jw)		Sandstone, siltstone, shale, coal seams
		Bundamba Group	Marburg Formation (upper beds) (Jbm^2)	Quartz sandstone, conglomerate, siltstone, shale
			Marburg Formation (lower beds) (Jbm^1)	Sublabile-labile sandstone, siltstone, shale
	TRIASSIC TO JURASSIC		Helidon Sandstone (R-Jbh)	Quartz sandstone
	PERMIAN TO TRIASSIC	Undifferentiated intrusions (P-Rg)		Diorite, quartz diorite, microdiorite granite, tonalite, aplite, granodiorite, gabbro
PALAEOZOIC	PERMIAN	Cressbrook Creek Group	Undifferentiated (Pc)	Mudstone, chert, rhyolite, andesite, conglomerate, sandstone
			Buaraba Mudstone (Pcb)	Mudstone, shale
			Box Gully Formation (Pcg)	Conglomerate, sandstone
			Biarraville Formation (Pcr)	Chert, sandstone, siltstone, mudstone, rhyolite, breccia, limestone, conglomerate

Buaraba Mudstone (Pcb)

The Buaraba Mudstone consists predominantly of black and brown carbonaceous mudstone and shale. The mudstone is usually massive but in places rhythmically interbedded with sandstone.

The unit crops out in a small area in the vicinity of Mount Cross and is usually weathered. It is of no significance for extractive industries.

Undifferentiated Cressbrook Creek Group (Pc)

This unit is confined to an area just south and west of Mount Cross and it crops out mainly in the bed of Alice Creek. The rocks consist of interbedded mudstone, massive dark grey to dark green chert, grey rhyolite, andesite, conglomerate, and light grey medium-grained sandstone.

The rhyolite could find use as road-base material.

Undifferentiated Permo-Triassic Intrusions (P-Rg)

These rocks are exposed in the northern part of the Gatton Shire and consist mainly of grey-green to brown diorite, quartz diorite, and black fine-grained microdiorite. The rocks in the northern part of the outcrop area are less weathered than those in the south, and further investigations could locate microdiorite suitable for use as screenings and concrete aggregate.

MESOZOIC

Bundamba Group

The Triassic to Jurassic Bundamba Group is the most extensive geological unit in the Gatton and Laidley Shires.

The Bundamba Group has been divided into the Helidon Sandstone and the Marburg Formation. The Marburg Formation has been further subdivided into two beds: (i) lower beds of lithic sandstone and shale, and (ii) upper beds of quartz sandstone with minor siltstone and shale. The terms Marburg Formation (lower beds) and Marburg Formation (upper beds), as used by Zahawi (1975), have been adopted in this report.

Helidon Sandstone (R-Jbh)

This unit extends mainly over the northern half of the Gatton Shire. It consists of hard and massive, medium to coarse-grained quartz sandstone with a generally clayey matrix. Cross-bedding is common, and pebble bands occur in some parts.

The Helidon Sandstone generally forms rugged topography with steep hillsides and narrow valleys. The stone has been used for building. Lateritic ironstone nodules are present in isolated detrital or in situ deposits of a few centimetres to about 1 m thickness, mainly in the northwest of the outcrop area of Helidon Sandstone. The nodules are rich in iron, poor in humic material, and with or without quartz. They usually range from 5 to 20 mm in size and occur on both flat and gently sloping sandstone surfaces. The ironstone gravel represents a significant local source of road-base material.

Marburg Formation (lower beds) (Jbm^1)

This unit crops out mainly in the Laidley Shire. It consists of fine to medium-grained, lithic and feldspathic sandstone, and siltstone and shale. The sandstone is generally soft and clayey and gives rise to subdued undulating relief.

Deeply weathered shale could be suitable for use by structural clay industries if beds of sufficient thickness are located. Completely weathered sandstone is used as base-course for local roads. Lateritic ironstone occurs also on the lower beds of the Marburg Formation and is used in road construction.

Marburg Formation (upper beds) (Jbm^2)

These beds crop out in the southern and western parts of the Gatton Shire, and in the central and southern parts of the Laidley Shire. The unit is composed of alternating beds of hard sandstone and soft sandstone, siltstone and minor shale. The beds of hard sandstone consist of medium to very coarse-grained quartzose sandstone with calcareous or ferruginous cement. Crossbedding and pebble lenses are common. The soft beds comprise medium to coarse-grained clayey sandstone, siltstone and shale.

Because of its variable hardness, the sandstone is not suitable as a building stone. Thick and deeply weathered beds of shale could have potential for structural clay.

Walloon Coal Measures (Jw)

The Walloon Coal Measures occur as scattered exposures in the southern parts of both shires. The unit consists of fine to medium-grained sandstone, siltstone and shale, with minor coal seams. The sandstone is soft and friable.

Weathered shale has some potential for structural clay products. Some outcrops are located at relatively high elevations and may be inaccessible.

Main Range Volcanics (Tm, Tv)

The Main Range Volcanics consist of olivine basalt and minor trachyte. The basalt is made up of several flows which are exposed in the escarpment at the eastern flank of the Great Divide. They also form a number of high mountain peaks in the southern part of the shires, for instance Mount Mistake, Mount Lowe and Mount Zahel.

Generally, the basalt flows in the area are deeply weathered and are located at relatively high elevations. They are of little significance for the extractive industries.

The trachyte is located at the southern tip of both shires. Its degree of weathering is unknown; however, the rock occurs at such an elevation that its extraction is rendered uneconomical.

Basalt plugs are scattered in the central and northern parts of the shires, and could mark possible feeders of the Main Range Volcanics. These plugs are usually less weathered than those on the Main Range, and some have been worked for top-course material. The basalt contains some olivine crystals and is generally fresh to slightly weathered. The plugs display columnar jointing and occasionally are surrounded by steep talus slopes.

Lacustrine Deposits (Cza)

Cainozoic lacustrine deposits are associated with lakes and lagoons, such as Lake Clarendon, Seven Mile Lagoon and One Mile Lagoon in the northern part of the Laidley Shire.

The deposits consist mainly of dark organic clays, which were probably deposited in areas where tributary streams have been blocked by levee banks. These deposits have no significance for extractive industries.

Colluvium (Qx)

Colluvial or hillwash deposits are restricted to lower slopes marginal to stream alluvium. These deposits consist of gravel, sand and silt and are seldom very thick. They are of little significance for the extractive industry.

Alluvium (Qa)

Alluvium is found in association with all the major streams. The deposits generally consist of poorly sorted gravel, sand and silt with gradually decreasing grain size from gravel at the base of the unit to clayey silt at the top. The alluvium may attain a thickness in excess of 30 m.

Gravel and medium to coarse-grained sand are worked at Lockyer Creek. Some alluvial clays are suitable for structural clay products.

QUARRY ROCK

In this report, the term 'quarry rock' refers to hard rock broken from a face, weathered or soft rock broken, ripped or scraped from quarries or pits, and laterite gravels scraped from shallow pits. Workings of building stone are described in a following chapter.

'Road pavement gravels' include three quality groups (i) top-course, (ii) base-course, and (iii) road maintenance gravels. Top-course materials have a California Bearing Ratio (CBR) of over 45 and are used for highways and other major roads as the whole or only the top part of the pavement layer. Some of the materials are suitable as excavated, others are mixtures of crushed rock and binder material.

Base-course materials have a CBR of 20 to 45 and are used for minor roads and the lower layers of some highways. Weathered rocks that can be used as excavated in simple bulldozing or scraping operations are preferred.

Road-maintenance gravels are of poorer quality than the base-course material and are used for the maintenance of unsealed roads and road shoulders.

The term '<u>crushed screenings</u>' refers to clean crushed rock used for bitumen screenings and concrete aggregate.

Rock quarrying operations on freehold land are administered by the Shire Council. The extraction of quarry rock on Crown land is controlled by the Department of Forestry.

GEOLOGICAL SOURCES

The main rock types that have been quarried in the two shires are the lateritic ironstone gravels, weathered sandstone, and Tertiary basalt.

The lateritic gravels are sought for base-course materials as they can be scraped or excavated by bulldozing.

The weathered sandstone of the lower beds of the Marburg Formation is soft and clayey, and is used as excavated for base-course and binder material.

Tertiary basalt plugs have been worked in the past for base-course and top-course materials, and for screenings.

PRESENT PRODUCTION

Most of the quarry rock currently produced in the two shires is laterite gravel and weathered sandstone. The small basalt quarried south of Gatton are presently inactive. The requirements for pavement gravels are met by the Mount Marrow quarry (basalt) in the Moreton Shire.

The laterite gravels are used as excavated or are mixed with crushed rock. A large number of small scrapings have been worked over the years, mainly in the vicinity of Balaam Hill and to the north of Helidon; most deposits are now worked out and the scrapings are abandoned.

Sandstone is worked in one quarry at Laidley. A number of small and abandoned workings are located throughout the shires; most have been worked out in recent years.

The workings of quarry rock in the Gatton and Laidley Shires are listed in Table 2 and their locations shown on Plates 1 and 2. The following are some of the more significant operating workings in the area.

Montgomery's Scraping (1158):

This is one of the largest scrapings of laterite in the area. It is located near Lockyer northwest of Helidon. The ironstone is found under a thin layer of overburden. Between 1974 and June 1978, the Main Roads Department and the Gatton Shire Council extracted about 93 800 m^3. The material is used as maintenance gravel for rural roads, and has been used, mixed with crushed rock, as road top-course and base-course. Moderate reserves of laterite are still available.

Green Swamp Scraping (3764):

This is a large scraping north of Balaam Hill in the Laidley Shire. A 1 m thick layer of ironstone nodules is developed on the lower beds of the Marburg Formation. Soil of about 0.5 m thickness overlies the ironstone. Quantities of about 10 700 and 9 450 m^3 per year of lateritic gravel have been excavated by the Laidley Shire Council and the Main

Roads Department, respectively, mainly for use as base course. Large reserves of laterite may be present immediately to the west of the present workings.

Kruger's Scraping (3262):

This scraping of laterite gravel on Helidon Sandstone, northeast of Gatton is worked occasionally. The ironstone is found beneath 0.3 to 0.5 m of overburden. From 1974 to June 1978, about 39 460 m^3 of ironstone were removed. The material is used mainly as maintenance gravel for rural roads and occasionally as base-course for major roads.

Gatton-Esk Road Scraping (3564):

In this scraping next to the Gatton-Esk Road ironstone nodules formed on the Helidon Sandstone in an approximately 0.7 to 1.0 m thick layer. Overburden consists of clayey sand and is about 0.5 m thick. The ironstone is used as maintenance gravel and reserves are expected to be moderate. Production figures are not available.

Range Quarry (4240):

This is a scraping in the Little Liverpool Range on the road between Laidley and Grandchester. The material consists mainly of completely weathered and decomposed sandstone of the upper beds of the Marburg Formation.

The material is used for road maintenance by the Laidley Shire Council and as base-course by the Main Roads Department. An average of 21 000 and 21 750 m^3 of material per year has been extracted since 1975 by the Shire Council and the Main Roads Department respectively. Moderate reserves of similarly weathered sandstone could possibly be available in the area.

Mount Whitestone Quarry (1637):

This basalt quarry is located on the Gatton-Clifton road, approximately 20 km southwest of Gatton. The quarry was described in detail by Shipway (1961). The basalt, which is part of a plug, is slightly weathered to fresh with some olivine crystals. The near-vertical face of the quarry exhibits columnar jointing with an average column width of 20 to 30 cm.

The quarry has been worked intermittently by the Gatton Shire Council and the Main Roads Department. Between August 1973 and March 1974, the Main Roads Department extracted approximately 7 645 m^3 of rock for the Gatton-Clifton road. Crushed rock from this quarry has been used for base-course, top-course and screenings.

There are large reserves of basalt in the quarry area; however, owing to the almost vertical working face, further extraction could be relatively difficult and dangerous.

POTENTIAL DEPOSITS

The Gatton and Laidley Shires have hardly any potential sources of quarry rock of good quality. The only available hard rock occurs in the Gatton Shire and is limited to two or three small basalt plugs. The extensive basalt of the Main Range Volcanics in the southern parts of the shires is deeply weathered, and only the laterite formed on the Helidon Sandstone and on the lower beds of the Marburg Formation in the northern parts of the shires provides a welcome source of road maintenance gravels and base-course for local roads. However, access to some of the larger deposits north of Helidon might prove to be difficult, and the extent of scrapings necessitated by the limited deposit thickness is likely to cause an undesirable environmental impact.

Weathered rocks of other geological units will be of local significance as sources of fill, road maintenance material, and binder material.

Potential deposits of quarry rock are described for basalt, laterite gravel, and sandstone.

Basalt

Ropeley Road: A basalt plug of 20 m height, 150 m length and 50 m width forms a low hill in the alluvial flats of Deep Gully near Ropeley Road. Two diamond drillholes on the hill (GR 265 431 and 265 432) intersected 0.5 to 0.8 m of soil over moderately to completely weathered basalt. Fresh to slightly weathered rock was encountered at about 2 m below the surface. The basalt is dark grey and fine-grained, and has ironstained, chlorite-lined or calcite-veined joints. The plug was drilled to a depth of 25 m.

Table 2: Rock Quarries, Pits and Scrapings

Working Number (Grid Reference)	Approx. Location and Name	Geological Formation and Rock Type	Status	Operator	Uses	Comments
0963	Murphy's Creek	R-Jbh - Lateritic gravel	Occasionally worked	G.S.C.	Base-course	
1158	Murphy's Creek (Montgomery's Scraping)	R-Jbh - Lateritic gravel	Operating	G.S.C.	Base-course	Moderate reserves
1553	North of Helidon	R-Jbh - Lateritic gravel	Abandoned	?	Base-course	
1637	Mt Whitestone	Tv - Basalt	Occasionally worked	G.S.C., M.R.D.	Road base-course, top-course, screenings	Large reserves
2340	Upper Tenthill	Jbm^1 - Weathered sandstone	Abandoned	M.R.D.	Binder	Small working
2643	Ropely Road	Tv - Basalt	Abandoned	?G.S.C.		Old face 20 m high
3046	South of Gatton	Jbm^1 - Weathered sandstone	Disused	?	Binder	
3153	Northeast of Gatton	Jbm^1 - Lateritic gravel	Abandoned	G.S.C.	Base-course	
3262	Gatton-Esk Road (Kruger's Scraping)	R-Jbh - Lateritic gravel	Occasionally worked	T. Kruger	Base-course, maintenance gravel	
3564	Gatton-Esk Road	R-Jbh - Lateritic gravel	Operating	Pomeranke	Base-course, maintenance gravel	
3664	West of Balaam Hill	Jbm^1 - Lateritic gravel	Abandoned	L.S.C.	Base-course	

Working Number (Grid Reference)	Approx. Location and Name	Geological Formation and Rock Type	Status	Operator	Uses	Comments
3764	Balaam Hill (Green Swamp Scraping)	Jbm^1 - Lateritic gravel	Operating	L.S.C., M.R.D.	Base-course; top-course for secondary roads	Moderate to large reserves
4240	Laidley (Range Quarry)	Jbm^1 - Weathered sandstone	Operating	L.S.C., M.R.D.	Base-course, maintenance gravel	Moderate reserves
4547	South of Hatton Vale	Jbm^1 - Lateritic gravel	Disused	L.S.C., M.R.D.	Base-course	Small reserves
4556	Glenmore Grove	Jbm^1 - Lateritic gravel	Occasionally worked	L.S.C.	Base-course	Small reserves
9961 (not on map)	Murphy's Creek (Spring Bluff Quarry)	Tm - Basalt	Abandoned			Steep face, dangerous to work

Abbreviations: M.R.D. Main Roads Department
G.S.C. Gatton Shire Council
L.S.C. Laidley Shire Council

The rock is moderately fractured and will require blasting at depths greater than 2 to 4 m below the surface.

The results of Aggregate Crushing Tests, Washington Degradation Test, and Bulk Density Determination for rock from this deposit (Table 3) indicate suitability for crushed screenings and pavement gravels. The deposit is a significant source of quarry rock.

Table 3 : Results of Tests on Potential Basalt Aggregate

Test	Result	
	Ropeley Road	Paradise Creek
Aggregate Crushing Value (dry) (19.0 mm-13.2 mm)	9.1%	
Aggregate Crushing Value (dry) (13.2 mm- 9.5 mm)	12.3%	
Aggregate Crushing Value (wet) (13.2 mm- 9.5 mm)	13.4%	
Washington Degradation	75	87
Bulk Particle Density	2.91 Mg/m^3	3.02 Mg/m^3

Paradise Creek: A scree slope of basalt boulders, approximately 500 m long, covers the valley side of Paradise Creek at GR 185 365. The basalt boulders are generally fresh with some altered olivine phenocrysts, and their size is such that most can be crushed by a portable crusher. The result of the Washington Degradation Test of a rock sample (Table 3) indicates suitability for screenings and pavement gravels.

The deposit is considered to be of major significance but further detailed investigations are required to ascertain the thickness of the scree. Improvement of the track along Paradise Creek would be required prior to the commencement of quarrying operations.

Mount Whitestone: The small plug of basalt northwest of Mount Whitestone has been quarried (1637) for crushed-rock products, and large reserves remain. However, a major reorganisation of the quarry layout would be required to

reduce the dangerously steep working face and provide safe benching. The deposit is therefore considered to be a possible source only.

Murphy's Creek: A steep slope of basalt scree on the southern valley side of Murphy's Creek shows boulders similar to those of Paradise Creek. However, this deposit is considered to be of minor significance because the slope may be too steep for the safe operation of machinery.

Lateritic Gravel

Northeast of Helidon: A layer of detrital ironstone gravel ranging from 0.8 to 1.2 m in thickness has been proved by backhoe trenching in an area of 500 by 50 m, approximately 8 km northeast of Helidon (GR 172 582) on the Helidon-Ravensbourne road. The ironstone is overlain by overburden of 0.4 m maximum thickness. The individual ironstone nodules are well-rounded and range from 1 to 7 cm in diameter. The size of the nodules and the general thickness of the lateritic zone tend to increase uphill. About 50 m to the east of the road, the ironstone gradually changes into angular cobbles and boulders of the Helidon Sandstone. Another, narrower strip of ironstone is expected to be present on the western side of the road.

The deposit is close to road access and constitutes a significant source of road-base material.

Gatton-Esk Road near Springdale: A lateritic layer of ironstone nodules (about 1 cm diameter), intermixed with an appreciable amount of brown clayey lateritic soil, occurs on sandstone at GR 328 618. The layer is approximately 80 cm thick and has about 30 cm of overburden.

This ironstone layer could be an extension of the one worked in scraping 3262. The deposit has been categorized as a significant source because of available access.

East of Murphy's Creek: A possible deposit of ironstone gravel is shown 3 km east of the township of Murphy's Creek between Fifteen Mile Creek and Murphy's Creek (GR 098 628). Trial excavations and access are required before a scraping can be contemplated.

White Mountain: This possible deposit of ironstone gravel between White Mountain and Racecourse Creek (GR 128 645) has been delineated from airphoto interpretation. The area is located in gently sloping and forested terrain. Trial excavations are required to prove a workable deposit.

Mount Cross: A possible deposit of ironstone gravel extends along the catchment divide between Alice and Paradise Creeks southwest of Mount Cross (GR 114 625). Trial excavations are required and access may prove to be difficult.

Upper Sheep Creek: A possible deposit of ironstone gravel is shown along part of the catchment divide between Sheep and Alice Creeks (GR 115 586). The area borders onto the Helidon-Ravensbourne road. Trial excavations are required to establish suitable reserves.

East of Mount Perseverance: A road cut of the Helidon-Ravensbourne road shows a lateritic ironstone layer of about 15 to 20 cm thickness in this area (GR 207 666). The individual nodules are well-rounded and about 1 to 2 cm in diameter. Ironstone layers of greater thickness could possibly be present to the east and west of the road.

Gatton-Esk Road near Yellow Gully: This possible deposit is located near the northern boundary of the Laidley Shire. Some ironstone gravel is visible on the ground surface; however, further investigation will be necessary to ascertain the thickness and extent of the lateritic layer.

Sandstone

Weathered sandstone of the lower and upper beds of the Marburg Formation will continue to be a source of binder material and base course. Potential deposits have not been evaluated during this study but possible areas include the valley sides along the lower reaches of Laidley, Tenthill, Ma Ma, and Flagstone Creeks.

SAND, GRAVEL AND LOAM

Sand and gravel are natural detrital materials derived from rocks and minerals by weathering and having been transported by creeks and rivers. The grain size of sand ranges from 0.06 to 2 mm and that of gravel from 2 to 60 mm. Loam is a mixture of fine sand, silt and clay. Loam with low clay and silt content is used as bricklayer's loam; with higher silt and clay contents it is suitable for top dressing in landscaping.

The extraction of sand and gravel on freehold land is administered by the Shire Councils. The Irrigation and Water Supply Commission controls extraction from non-tidal streams. Extraction from Crown land is administered by the Forestry Department.

GEOLOGICAL SOURCES

Well-graded, fine to coarse-grained sand and gravel, suitable for concrete aggregate and other construction purposes, are present in the alluvial deposits of Lockyer Creek and some of its tributaries.

Deposits of coarse sand, gravel, cobbles and boulders of basalt occur in the upper reaches of Laidley and Tenthill Creeks. Other smaller deposits are found in the beds of Ma Ma and Flagstone Creeks.

PRESENT PRODUCTION

Most of the sand and gravel produced in the area is used for blending in concrete aggregate, either for ready-mixed concrete or for concrete blocks. Fine sand and sandy loam are used for bricklayer's loam. The workings are mainly located in the bed of Lockyer Creek between Helidon and Grantham. Most of the production serves the Toowoomba market.

All workings in the Gatton and Laidley Shires are listed in Table 4 and their locations are shown on Plates 1 and 2. Current operations are described below.

Table 4 : Sand, Gravel and Loam Pits

Working number (Grid reference)	Approximate location	Material worked	Status	Operator	Uses	Comments
1352	West of Helidon	Sand, gravel	Disused	?	?Concrete aggregate	
1451	South of Helidon	Sand, gravel	Operating	Downs Precast Concrete, M.R.D.	Concrete aggregate, topcourse	Nearly worked out
1849	West of Grantham	Sand, gravel	Operating	Martin & Sons	Concrete aggregate	Small reserves
1950	Sandy Creek at Grantham	Sand, gravel and loam	Operating	Martin & Sons	Concrete aggregate, bricklayer's loam	Small reserves
2439	Upper Tenthill	Sand, gravel	Disused	?M.R.D.	Top-course	

Abbreviations : M.R.D. Main Roads Department

South of Helidon (1451):

This is a large operation along Lockyer Creek, south of Helidon. A total of about 1 910 m^3 of poorly graded, medium to coarse-grained sand and fine to coarse gravel has been extracted from the creek bed by Downs Precast Concrete for use as concrete aggregate. The Main Roads Department used aggregate from this working for road top-course. The reserves of sand and gravel in the creek bed are nearly worked out.

West of Grantham (1849):

Two draglines and a floating dredge are used by Martin and Sons in this working to extract sand and gravel from Lockyer Creek. The sand is medium to coarse-grained, and is used mainly for concrete aggregate. A total of 16 552 m^3 of material has been extracted during the period from October 1977 to June 1978, and remaining reserves are small.

Sandy Creek at Grantham (1950):

Medium to coarse-grained sand and gravel are produced from this site by Martin and Sons. Some loam has also been removed from the northern bank for use as bricklayer's loam. The sand is used mainly for concrete aggregate. Total production from this working to June 1978 was 6 165 m^3.

Reserves are small, and any further removal of loam from the northern bank will lead to additional erosion of that bank.

POTENTIAL DEPOSITS

The Gatton and Laidley Shires have few potential sources of sand and gravel of good quality. Suitable deposits which can be worked economically and to environmentally acceptable standards, are isolated in distribution and of extremely limited extent. Most of the deposits occur in the bed of Lockyer Creek and in the few low alluvial terraces between Helidon and Grantham. In the area between Gatton and Glenore Grove to the east, the bed of Lockyer Creek is generally void of extractable sand and gravel, and only some small and isolated deposits of clean fine sand can be found.

Large deposits of coarse sand and gravel with abundant cobbles and boulders occur in the upper reaches of Laidley and Tenthill Creeks. The percentage of oversize material is greater in the Tenthill Creek deposits. Some small deposits of sand and gravel occur in Ma Ma and Flagstone Creeks.

Southwest of Helidon

Reconnaissance drilling indicates the presence of mainly gravelly sand under the low alluvial terrace adjacent to Lockyer Creek at GR 132 516. The sand is medium to coarse-grained, and the gravel is sub-angular and ranges up to 60 mm in diameter.

The deposit of gravelly sand is 3 to 4 m thick and is overlain by 4 to 6 m of fine-grained sand and loam.

South of Helidon

The middle and lower alluvial terraces of Lockyer Creek were investigated by 8 auger holes in this area (GR 136 508). The lower terrace consists of 1 to 3 m of sandy loam overlying 1 to 7 m of gravelly sand and sandy gravel. The middle terrace consists of loam, clayey sand and clay to 8 or 10 m depth. One auger hole intersected 1 m of coarse-grained gravelly sand at 8 m depth.

The deposit is shown as a minor source of loam; the sand and gravel under the lower terrace may be of long-term interest.

Northwest of Grantham

Some loam and coarse sand and gravel are present on the floodplain of Sandy Creek in this area (GR 194 511), but further investigations are required to prove a workable deposit.

Laidley Creek at Thornton

A high alluvial terrace along Laidley Creek 1 km south of Thornton (GR 386 216) consists of gravel and medium to coarse sand. The sand and gravel are overlain by 3 to 5 m of loam.

This deposit is a minor source of loam and aggregate for concrete and road pavement gravel.

Laidley Creek at Townson

A deposit of gravel, boulders, and medium to coarse sand occurs in the bed of Laidley Creek at GR 400 183. Further south, the creek carries mainly boulders with little sand and gravel.

The deposit is a possible source of aggregate. The high proportion of oversize material would require crushing as part of any economic operation.

CLAY MATERIALS

Clay materials include clay and weathered shale suitable for the manufacture of ceramic products by the application of high temperature. Most clay materials can be used for the manufacture of bricks, provided the specifications for shrinkage, strength, distortion, and cracking are met.

"Structural clay" is a term used in reference to clay suitable for the manufacture of bricks, glazed and non-glazed pipes, tiles, and common pottery. The term "special purpose clay", on the other hand, refers to a type of clay suitable for the manufacture of pottery, whiteware, fire bricks, and light-weight aggregate.

Clay materials are not being worked in the Gatton and Laidley Shires. The nearest brickworks are in the Ipswich and Toowoomba districts.

GEOLOGICAL SOURCES

Geological formations containing clay materials have been sampled and tested to a limited extent to assess their potential for the production of ceramic clay. No attempt was made to delineate clay deposits during this investigation.

Marburg Formation (lower beds)

The results of clay firing tests on 10 samples of weathered sandstone were disappointing. Six of the samples tested were unsuitable for any ceramic products, 3 were suitable for bricks only, and 1 was suitable for bricks, pipes and common pottery. Although the shrinkages were low, water absorption was moderate to high and a number of the samples became friable or cracked upon drying. The firing colours of suitable samples range from orange at low temperature (900°C) to brown, and green-grey in one sample, at high temperature (1200°C). Suitable clay samples came from northeast of Lake Clarendon village and from south of Grantham.

Walloon Coal Measures

Of seven samples tested from this formation, only one from an auger hole southwest of Thornton proved to be suitable for the manufacture of structural products such as bricks, non-glazed pipes, and common pottery. The firing

colours of this sample range from orange-brown to dark brown with increasing temperature.

Although clay materials from the Walloon Coal Measures are used commercially by brickworks at Kleinton north of Toowoomba where they represent the main available source of structural clay, the works in the Ipswich district have not used them much because better materials are available in shales from the Ipswich Coal Measures and Tertiary clays. Outcrops of Walloon Coal Measures are restricted to the southern parts of the Gatton and Laidley Shires where their location relative to brickworks is disadvantaged by long transport distances.

Alluvium

Firing tests on 28 samples of alluvial clay indicate that only 39 per cent of the samples are suitable for the manufacture of structural clay products. The firing shrinkage of the suitable samples is generally low to moderate (0-8.8%), but the water absorption moderate to high (5-15%) at 1100°C. The colours range from orange at low temperature to dark red or brown at high temperature. The suitable clay samples came from the alluvium of Lockyer Creek south and northwest of Helidon and northeast of Gatton, and from the alluvium of a tributary of Laidley Creek north of Laidley.

A clay sample from north of Helidon (GNS 17) proved suitable for the manufacture of bricks, glazed and non-glazed pipes, common pottery, and tiles.

Generally, the suitability of the alluvial clays for ceramic use is impaired by the presence of carbonate material and by the high drying and firing shrinkages which cause cracking of the fired ware.

BUILDING STONE

Sandstone of the Helidon Sandstone has been quarried in the Helidon District for building stone since 1890, and early examples of its use can be seen in the Treasury Building in Brisbane and in the South Brisbane Town Hall. Only two of the quarries around Helidon are still operating, Wright's Quarry (GR 165 558) and Ziegler's Quarry (GR 120 567). Both quarries produce building and monumental stone, primarily for restoration work.

The Helidon Sandstone in Wright's Quarry is generally white-grey to light brown, medium-grained, and slighly to moderately weathered. The sandstone is overlain by a relatively thin overburden of soil, and reserves of stone are large.

The sandstone is excavated in large blocks from pits that often reach a depth of 10 m below ground surface. These blocks are then sawn into the required sizes and shapes. The present production is unknown and would fluctuate considerably subject to demand for building and monumental stone. Richards (1918) and Wolff (1957) give physical properties and chemical analyses for stone from this quarry.

Ziegler's Quarry is worked in the same way in similar sandstone and has also large reserves.

The large area of Helidon Sandstone north of Helidon and Gatton is densely forested and generally has only a thin soil cover. Outcrops of massive and hard sandstone occur along Redbank, Sandy and Alice Creeks. Access into this area is limited and additional sites of quarryable building stone may be found with further investigation if required. Some of the hard sandstone of the upper beds of the Marburg Formation could be suitable for building stone; however, the variety in colour and the presence of interbeds of soft sandstone, siltstone and shale would result in higher quarrying costs.

DIATOMITE

Diatomite is being worked near Black Duck Creek (GR 172 218) in the south of the Gatton Shire by Industrial Minerals. The diatomite is white and massive. It occurs in lenses of about 2 m thickness between basalt flows. The first recorded production was in 1936, and calcination and packaging operations were established at the site in 1973.

It is estimated that the deposit is continuous over an area of about 30 ha with reserves approximating 600 000 tonnes (Bonner, 1951). The present rate of production is estimated to be 700 to 800 tonnes per year.

Diatomite is used mainly as a filtering agent, insulator, and as an absorbent of oil in the motor maintenance industry.

OTHER MINERALS

Few occurrences of metallic minerals have been recorded in the Gatton and Laidley Shires.

In the early part of this century, copper pyrite was mined in an area approximately 7 km north-northeast of Murphy's Creek (Saint-Smith, 1920). Some thin veins of lead and silver were associated with the copper. The deposits proved to be small and mining operations became uneconomical.

Small amounts of gold in association with pyrite and arsenopyrite have been reported to occur in the Alice Creek area 5 km northeast of Lockyer (Cribb, 1937). Olivine crystals of gem quality were recorded by Cameron (1910) in Tertiary basalt at the Spring Bluff railway station. Some red garnet and topaz has been reported to occur in alluvium north of Withcott in the Gatton Shire.

CONCLUSIONS

Quarry rock suitable for crushed aggregate and screenings is scarce in the Gatton Shire and almost non-existant in the Laidley Shire. The use of crushed rock brought from quarries in the adjacent Moreton Shire to meet the demand in the Gatton and Laidley Shires is expected to continue.

The Gatton Shire has two deposits of basalt suitable for the production of crushed rock products, at Ropeley Road and at Paradise Creek; both deposits require immediate preservation for future local use. Ironstone gravel occurs in the northern part of the Gatton Shire and two deposits, near the Gatton-Esk road and near the Helidon-Ravensbourne road, are considered to be of immediate importance as sources of road base and maintenance gravel.

Creek sand and gravel is scarce in both shires as accessible deposits in the bed of Lockyer Creek are largely worked out. Some reserves are present in lower terraces of Lockyer Creek and Sandy Creek in the Gatton Shire, but overburden of loam is generally too thick to allow the economical recovery of the sand and gravel alone. The loam is suitable as bricklayer's loam and top-dressing soil.

The only deposits of sand and gravel in the Laidley Shire are located in the upper reaches of Laidley Creek; they contain excessive amounts of cobbles and boulders.

Major clay deposits were not located in the Gatton and Laidley Shires. The potential of alluvial clays and clays from the lower beds of the Marburg Formation for ceramic use seems to be small, and the results of tests carried out on clays from the Walloon Coal Measures were generally disappointing.

Demand for building stone from quarries in the Helidon district is generally low and reserves are more than adequate to meet demand. The only mineral production in the area comes from the diatomite mine at Black Duck Creek, the reserves of which are estimated to be sufficient to sustain present production levels for about 750 years.

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GEOLOGICAL SURVEY OF QUEENSLAND

DEPOSITS OF EXTRACTIVE MATERIALS

ESK

1:100 000 SERIES

Regional geology from, Z.Zahowi (1975) G.S.Q. Record 1975/36
Economic Geology: Gatton and Laidley Shires by Z. Zahowi 1977–78

REFERENCE

CAINOZOIC	QUATERNARY		Qa	*Alluvium: gravel, sand, silt*
			Qx	*Colluvium: gravel, sand, silt*
			Cza	*Organic clay as lacustrine deposits*
	TERTIARY	Main Range Volcanics	Tv	*Basalt plugs*
			Tm	*Basalt*
MESOZOIC	JURASSIC	Bundamba Group, Marburg Formation	Jbm^2	*Upper beds: quartz sandstone, conglomerate, siltstone, shale*
			Jbm^1	*Lower beds: sublabile–labile sandstone, siltstone, shale*
			Jbm	*Sandstone, siltstone, shale and minor conglomerate*
	TRIASSIC TO JURASSIC	Bundamba Group, Helidon Sandstone	R-Jbh	*Quartz sandstone*
	PERMIAN TO TRIASSIC	Undifferentiated Intrusions	P-Rg	*Diorite, quartz diorite, micro diorite, granite, tonalite, aplite, granodiorite, gabbro*
PALAEOZOIC	PERMIAN	Cressbrook Creek Group, Undifferentiated	Pc	*Mudstone, chert, rhyolite, andesite, conglomerate, sandstone*
		Buaraba Mudstone	Pcb	*Mudstone, shale*
		Box Gully Formation	Pcg	*Conglomerate, sandstone*
		Biarraville Formation	Pcr	*Chert, sandstone, siltstone, mudstone, rhyolite, breccia, limestone, conglomerate*

EXISTING WORKINGS OF ROCKS AND MINERALS

1756 — *Major or significant rock quarry*
4240 — *Minor rock quarry or scraping*
2439 — *Sand and gravel working*
1352 — *Sand or loam working*
1722 Di — *Working of other materials as shown*

Deposit numbers correspond to nearest 1000 metre grid intersection

POTENTIAL DEPOSITS OF ROCKS AND MINERALS

	Quarry Rock	Sand and gravel
Significant sources, Material type as shown	Bs	S-G
Possible or minor sources, Material type as shown	Is	S-G

Ba Basalt; Bs Building stone; Di Diatomite; Is Ironstone; Lm Loam; S-G Sand and gravel

AUSTRALIAN MAP GRID ZONE 56 1000 METRE INTERVAL
HORIZONTAL DATUM: AUSTRALIAN GEODETIC DATUM 1966 VERTICAL DATUM: MEAN SEA LEVEL
PROJECTION: UNIVERSAL TRANSVERSE MERCATOR
MAGNETIC DECLINATION: 10 40' CORRECT FOR 1975 ANNUAL CHANGE 02' EASTERLY

GRID REFERENCE

TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METRES
SAMPLE POINT: *WHITE MOUNTAIN*

1. Locate first VERTICAL grid line to LEFT of point and read LARGE figures labelling the line either in the top or bottom margin — 10
2. Count number of divisions from grid line to division immediately to left of point — 1
3. Estimate tenths from this division to point — 5
4. Locate first HORIZONTAL grid line BELOW point and read LARGE figures labelling the line in either the left or right margin — 60
5. Count the number of divisions from grid line to division immediately below point — 5
6. Estimate tenths from this division to point — 6

SAMPLE REFERENCE 115 656 116656

KEY TO ADJOINING SHEETS

Kingaroy	Nanango	Nambour
Oakey	Esk	Caboolture
Toowoomba	Helidon	Ipswich

SOURCE MATERIAL

Mines Department field surveys and records

Base map prepared from 1:100 000 sheet compiled by the Royal Australian Survey Corps

SCALE 1:100 000

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 kilometres

DEPOSITS OF EXTRACTIVE MATERIALS

ESK

1:100 000 SERIES

9342

GEOLOGICAL SURVEY OF QUEENSLAND

DEPOSITS OF EXTRACTIVE MATERIALS

HELIDON

1:100 000 SERIES

Regional geology from Z. Zahawi (1975) G.S.Q. Record 1975/36
Economic Geology: Gatton and Laidley Shires by Z. Zahawi 1977–78

REFERENCE

CAINOZOIC	QUATERNARY		Qa	Alluvium: gravel, sand, silt
			Qx	Colluvium: gravel, sand, silt
			Cza	Organic clay as lacustrine deposits
	TERTIARY	Main Range Volcanics	Tv	Basalt plugs
			Tm	Basalt, minor trachyte
		Walloon Coal Measures	Jw	Sandstone, siltstone, shale, coal seams
MESOZOIC	JURASSIC	Bundamba Group: Marburg Formation	Jbm²	Upper beds: quartz sandstone, conglomerate, siltstone, shale
			Jbm¹	Lower beds: sublabile–labile sandstone, siltstone, shale
			Jbm	Sandstone, siltstone, shale and minor conglomerate
	TRIASSIC TO JURASSIC	Bundamba Group: Helidon Sandstone	R-Jbh	Quartz sandstone

EXISTING WORKINGS OF ROCKS AND MINERALS

1756 Major or significant rock quarry
4240 Minor rock quarry or scraping
2439 Sand and gravel working
1352 Sand or loam working
1702 Working of other materials as shown

Deposit numbers correspond to nearest 1000 metre grid intersection

POTENTIAL DEPOSITS OF ROCKS AND MINERALS

	Quarry Rock	Sand and gravel
Significant sources Material type as shown	Ba	S-G
Possible or minor sources Material type as shown	Is	S-G

Ba Basalt
Bs Building stone
Di Diatomite
Is Ironstone
Lm Loam
S-G Sand and gravel

AUSTRALIAN MAP GRID ZONE 56 1000 METRE INTERVAL
HORIZONTAL DATUM: AUSTRALIAN GEODETIC DATUM 1966 VERTICAL DATUM: MEAN SEA LEVEL
PROJECTION: UNIVERSAL TRANSVERSE MERCATOR
MAGNETIC DECLINATION: 10 40' CORRECT FOR 1975 ANNUAL CHANGE 02' EASTERLY

GRID REFERENCE

TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METRES

SAMPLE POINT MT HALDON

1. Locate first VERTICAL grid line to LEFT of point and read LARGE figures labelling the line either in the top or bottom margin.	20	
2. Count number of divisions from grid line to division immediately to left of point.	4	
3. Estimate tenths from this division to point.		1
4. Locate first HORIZONTAL grid line BELOW point and read LARGE figures labelling the line in either the left or right margin.	20	
5. Count the number of divisions from grid line to division immediately below point.	2	
6. Estimate tenths from this division to point.		4
SAMPLE REFERENCE 241 224		241224

KEY TO ADJOINING SHEETS

Oakey	Esk	Caboolture
Toowoomba	Helidon	Ipswich
Allora	Warwick	Mt. Lindesay

SOURCE MATERIAL

Mines Department field surveys and records

Base map prepared from 1:100 000 sheet compiled by the Royal Australian Survey Corps.

SCALE 1:100 000

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 kilometres

DEPOSITS OF EXTRACTIVE MATERIALS

HELIDON

1:100 000 SERIES

9342