

Technical Data on Ablatio Sandstone, Helidon Queensland



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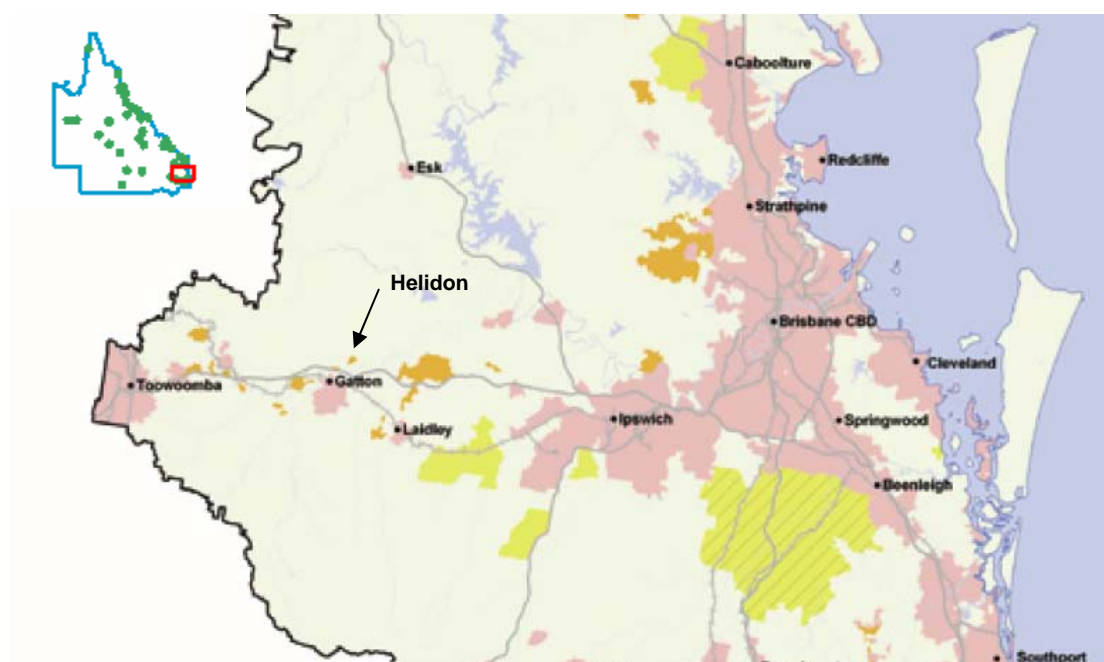
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1.0 Introduction

The Ablatio Sandstone Mining Lease (ML 50007) covering approximately 12 ha is located approximately 5 km from Helidon on Air Force Road, approximately 110 km from Brisbane, capital of Queensland (FIGURE 1). Current quarry resources are in excess of 25 years production at a rate of 10 000m³/a. Ablatio sandstone has high quality diamond saw cutting equipment and produces APlus Grade Export Block, A Grade Export Block, B Grade Dimension Stone, blocks, boulders, aggregates, pebbles and road base. Cut sandstone tiles and intricately cut sandstone products are also made for the building industry either as standard items or to specific orders.

FIGURE 1
MAP SHOWING LOCATION OF HELIDON



2.0 Regional Geology

The principal rock units in the Helidon area comprise the Bundamba Group which is divided into the Triassic to Jurassic Woogaroo Sub-Group and the overlying Jurassic Marburg Sub-Group (Wells and others, 1990). The two units can be distinguished by the composition of the sandstone, which in the Woogaroo Sub-Group is predominantly quartzose, whereas the Marburg Sub-group contains silty, quartzose to lithic (rock fragments) and feldspathic sandstone. Swelling clays often occur within the Marburg Sub-group.

Cranfield and Schwarzboch (1972) subdivided the Woogaroo Sub-group into three units, all of which were previously called the Helidon Sandstone. Because of the confusion of naming rock units within the area Cranfield and Schwarzboch recommended that the name "Helidon Sandstone" be discontinued to avoid confusion. However, Wells and others (1990) recommended that Helidon be restricted to the building stone unique to the Helidon area.

The Helidon Sandstone comprises hard and massive, fine to coarse grained sandstone, which generally has a clayey matrix. Cross bedding is common, and

pebble bands occur in parts of the sequence which comprises many fining upward cycles. The rocks currently quarried at Helidon occur near the top of the unit. The variation in topographic height of the workings is due to the presence of a major north-northwest trending fault which lies immediately to the east of the site. West of the fault the topography is subdued, in contrast to the higher, more dissected country to the east.

The dominant sandstone is quartzose, medium to coarse grained, generally poorly sorted, often pebbly and with a base colour varying from grey to white. The grains are mostly clear quartz, with some feldspar and rock fragments, while pebbles are milky quartz. Finer grained sandstone in the sequence is often micaceous. The cement is variable, with argillaceous, siliceous, carbonate and iron oxides common.

Across the Helidon area the base of the dimension stone layer is often marked by a thin siltstone or claystone band, fragments of which often occur in the overlying rocks. The dimension stone layer is generally composed of white, fine to medium grained sandstone with an argillaceous cement. The occurrence of brown colouration and liesegang (colour) banding within the layer appears to be due to weathering and the presence of overlying iron rich, lateritic gravels. The layer is up to 7 m thick and is softer than the underlying sandstones.

3.0 Summary of Helidon Sandstone (Adapted from Mann, 2001)

Historical test data including from the adjacent Comerford's Quarry is provided in TABLE 1. The compressive strength mentioned is the Uniaxial Compressive Strength (UCS).

**TABLE 1
SUMMARY OF HISTORICAL TEST DATA**

Test		Helidon Sandstone (Comerfords)	Helidon Sandstone (pre 1998 – Mann)	Helidon Sandstone (earlier – Mann)
Petrographics		All Colours	Purple, mauve, brown	All Colours
Compressive strength (MPa)	Dry	43 – 66	30-70	30-43
	Wet	22 – 32	11-40	6-32
Modulus of rupture (MPa)	Dry	11.3	6.0-17.9	No data
	Wet	4.7	2.4 -13.0	
Flexural strength (across bedding) (MPa)	Dry		6.5 – 12.9	No data
	Wet		2.6 – 6.7	
Flexural strength (along bedding) (MPa)	Dry		6.3 – 14.5	No data
	Wet		2.9 – 7.3	
Flexural strength (through bedding) (MPa)	Dry		6.8 – 8.2	No data
	Wet		2.4 – 3.0	
Absorption (weight %)		2.4 – 4.12	3.9 – 6.7	4.7 – 6.1
Density (kg/ m ³)		2,280 – 2,400	2,160 – 2,340	2,150- 2,320
Sodium sulphate soundness loss)			0.3% - 8.5%	8% - 10%

4.0 Ablatio Test Data (2005)

4.1 Petrographic Analysis (Report by Pontifex & Associates Pty Ltd)

Two slabs of pale brownish (to biscuit) coloured sandstone are described in this report from one thin section cut from each slab which were impregnated by blue epoxy to highlight porosity. The samples are from the Cathedral Quarry, near Helidon Queensland and called Export-Brown. The samples have been cut in “both orientations”, and in hand specimen the smaller slab appeared to have been cut at right angles to the bedding and was arbitrarily labelled “A”. The larger slab appears to have been cut at about 30° to the bedding and was arbitrarily labelled “B”. These are described separately, but (perhaps predictably) are seen to be very similar in each thin section, briefly summarised as follows.

Both samples are lithic quartz arenites (sandstones) about 35% composed of a loose-packed aggregate of detrital quartz grains. Extensive intergranular/interstitial matrix (33%) consists predominantly of kaolin ± minor possible cherty cryptocrystalline quartz. Other (relatively minor) detrital components are fragments, variably rich in sericite ± kaolin, quartz and limonite. Accessory small grains of zircon, tourmaline, rutile and possible anatase are scattered, rarely as inclusions in quartz. It is possible that some of the extensive kaolinite has replaced detrital grains, but most seems to represent an authigenic matrix (not obviously derived from feldspar). The minor porosity is largely void but, especially in sample ‘B’, may contain limonite. Sparse clays have an internal microporosity. The petrographic analysis is summarised in TABLE 2.

TABLE 2
SUMMARY OF PETROGRAPHIC ANALYSIS

Sample	A	B
Mineral	Vol %	Vol %
Single crystal detrital quartz grains	33	~30
Polycrystalline quartz ± sericite	6	9
Detrital muscovite	<1	<1
Kaolinised mica	<1	<1
Limonite-clay ± leucoxene fragments	10	10
Massive and schistose sericite-rich lithic grains	14	10
Tourmaline, zircon, rutile and anatase	Trace	Trace
Kaolinite matrix and grains ± possible cryptocrystalline silica	33	~35
Voids	3	3

The sandstone is composed predominantly of quartz (~33%), rock fragments (10-14%) within a kaolinitic matrix (~33%) with a relatively low porosity (3%). The general composition and modal abundance is comparable with other dimension stone presently being quarried in the Helidon region such as Comerford sandstone.

The weak layering, coarse texture and angularity of the quartz grains in conjunction with the low porosity suggest that the sandstone will have a relatively high compressive and flexural strength in a dried condition. The high clay content is likely to lead to a significant reduction in strength when the sandstone is tested in a soaked condition; a >50% reduction in strength may be expected and is typical for sandstone from this region.

The apparent absence of swelling clay such as smectite suggests that the durability (resistance to salt attack) of the sandstone is likely to be “good to moderate” probably

making the stone suitable for use in “moderately aggressive” wet / dry cycling environments (such as swimming pool surrounds) given that the loss of strength when wet is taken into account.

4.2 Point Load Tests (Indicative UCS)

Several non-destructive tests have been conducted on different samples from the Ablatio quarry to give an indicative strength of the sandstone. Seven different samples from a variety of locations and different sandstone colours have been tested and results are summarised in TABLE 3.

**TABLE 3
POINT LOAD TESTS**

Sample	Description / Colour	Indicative UCS (MPa)
A	Salt and Pepper (from top of quarry)	37.63
A2	Salt and Pepper (from bottom of quarry)	33.13
B	Brown	39.30
BB	Brown Bedded	40.63
C	White	34.75
D	Pink	25.10
E	Multi coloured	35.34

These samples have been tested using the Schmidt Hammer test. This testing method is non-destructive, however it only provides an indicative measurement of the dry strength of the sandstone.

4.3 Ongoing Tests

Selected X-Ray Diffraction (XRD) analysis is recommended if it is critical to more specifically identify (and/or quantify) the exact nature of the kaolin ± siliceous matrix more precisely than can be achieved by optical microscopy.

Ongoing UCS (including wet strength), Fracture Toughness, Triaxial and Cerchar Hardness tests of Helidon Sandstone are being carried out on particular sandstone colours at The University of Queensland. Durability and Water Absorption tests will also be completed. Based on tests on Ablatio sandstone carried out to date, the data in TABLE 2 can be used as a guide for material values.