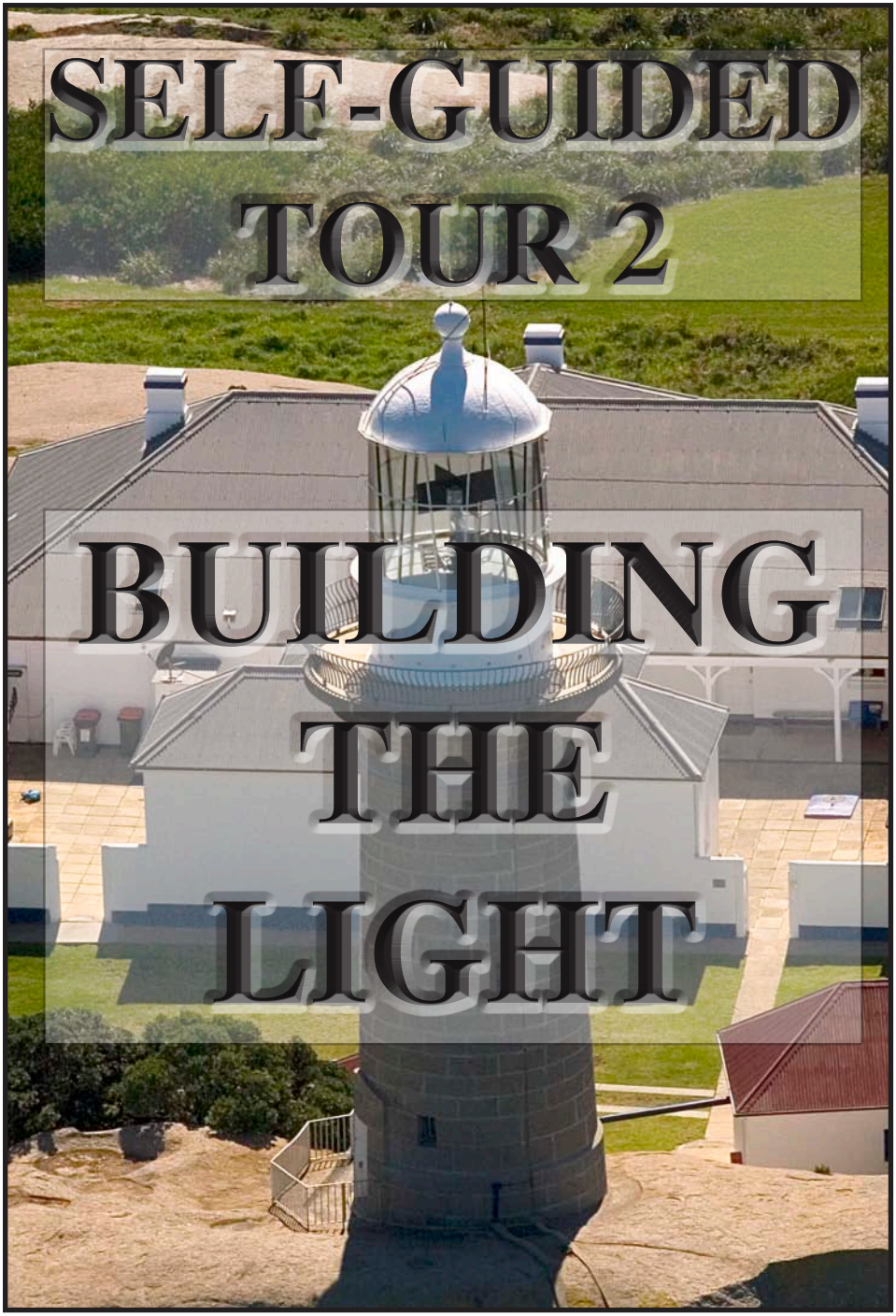

SELF-GUIDED
TOUR 2
BUILDING
THE
LIGHT

This self-guided tour focuses on the construction of the Lighthouse on Montague Island - in particular the work of the stonemasons.

PERHAPS BEGIN THIS TOUR SITTING ON THE STEPS LEADING UP TO THE TOWER...

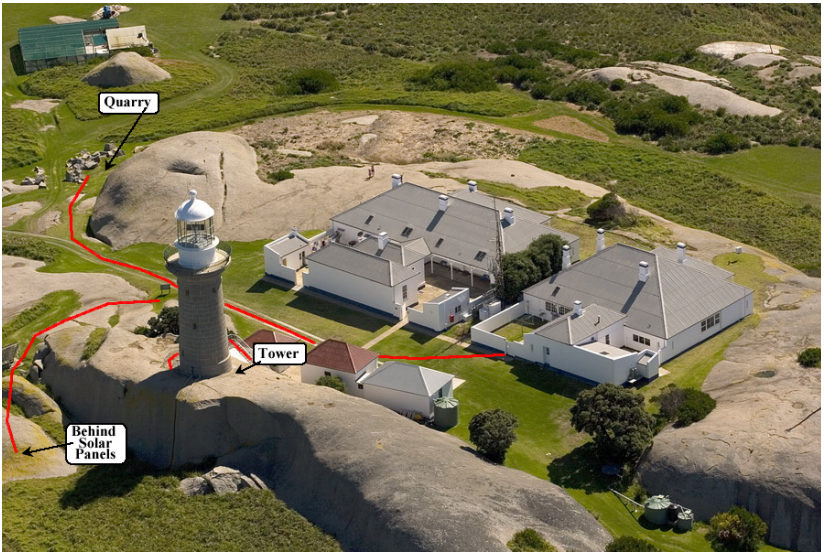
LOOK... at the tower:

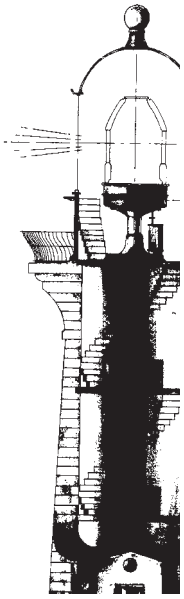
- Observe how it “grows” from the rock...
- Appreciate its proportions suggesting strength, durability and watchfulness.
- Notice the courses of blocks, the windows, the overhangs, the balcony and the lantern room at the top.

CONSIDER...

This Lighthouse has been operating continuously since 1881 - staffed until September 1986, and then automatically since 1986. The Australian Maritime Safety Authority (AMSA) now maintains the tower and light, totally funded by the shipping and insurance industries.

GUIDE TO YOUR TOUR





SIGNIFICANT DATES:

1873
Decision for a "First Order, Fixed and Flashing Light" on Montague Island

1877
Monies allocated within NSW budget – James Barnet, Colonial Architect, designs the lighthouse and buildings.

1878 – October
Tenders let – Musson and Co wins the tender.

1879 – June?
Musson surrenders his contract

1880 – July
Fresh tenders called – William H. Jennings of Sydney wins the tender.

1880 – September
Visitors impressed with Jennings' Progress.

1881 – October
Work completed by Jennings, 4 months ahead of schedule.

1881 – November 1st
Lighthouse is formally opened by the NSW Marine Board

THE DESIGN OF THE LIGHT STATION AND TOWER.

James Barnet, the Colonial Architect from 1865 to 1890, was responsible for some 15 lighthouses in NSW, in particular during the period 1875-1885.
Other lighthouses he designed include the Macquarie Light on Sydney's south head, after Greenway's tower experienced problems; Cape Byron; Norah Head; and the nearby Greencape light, south of Eden.

Other famous Barnet buildings include:

The Australian Museum (1864)
The GPO in Martin Place – also additions and alterations - (1866-90)
The Colonial Secretary's building (1878)
The Lands Department building (1876-81, 1888-93)

You can see a facsimile of Barnet's design for the Light station on the wall in the lounge in the Head Keeper's Quarters.

Barnet designed the tower to be made from locally quarried granite. He developed a fondness for the Island's granite, which led him to ship some blocks from the Island to Sydney to use as the bases of six of the columns in the Sydney GPO extensions on its Pitt Street side.

Originally the houses were to be made from granite as well, but work on their foundations revealed that brick would be the better option.

FIRST CONTRACTOR – WORK COMMENCES

MUSSON & COMPANY.
Musson's winning quote in 1878 was for £13,900.
Work started slowly according to reports, and some unfortunate events caused further problems for Musson.
Firstly, he blasted the rock just south of the tower, against Barnet's instructions, thereby cracking the large tor, causing the "position of the tower to be altered several feet". This blasting site and the crack can be seen during your tour of the tower. Secondly, in May 1879 the SS Monaro was wrecked at Bingi, while carrying building materials for Musson & Co for construction of the light.
All of this and more resulted in Musson surrendering his contract.

Interestingly, Musson's company went on to successfully build the Kayuga Bridge over the Hunter River, now the second-oldest iron lattice bridge in NSW.

WILLIAM H. JENNINGS WINS THE TENDER - WORK BEGINS ANEW!

Tenders were again called in 1880.
W.H. Jennings won with a quote of £16950.

Work began in earnest.
Jennings and his foreman Thomas Yates quickly established their supply lines by constructing a jetty with a crane at the existing Jetty Bay, where visitors currently come ashore. They set up a strong mooring system for boats and constructed a tramway from the jetty up to the light station area, with a horse-drawn tram cart used for the transfer of supplies and materials.

He reportedly provided "good and sufficient plant" and accommodation for the men.
Local Aboriginal people were included of the construction team.

A report in the local paper at the time – The Moruya Examiner – talks of the efficiency of Jennings' team "60,000 bricks, 100 casks of cement, 75 sheep having been landed under 24 hours."

Jennings finished the work in October 1881, four months ahead of schedule. The light was commissioned on November 1 1881.

LOGISTICAL CHALLENGES!

•The Island is remote. It has no reliable water supply other than two small known springs. For the workers in their tents there is little real shelter from the elements.

• In those days, everything depended upon supplies by ship.
A team of skilled tradesmen had to come from elsewhere to live and work and be fed and housed on the Island for all those months, separated from the mainland and their families.

• All the lighthouse apparatus and fittings had to be ordered from England (Chance Brothers in Birmingham). This was the era of the "clipper Ships", vessels combining steam engines and sail. To place the order for the navigational apparatus on Montague would take a minimum of 42 days for it to get to England, via steamship such as the Orient Line's "Lusitania". Let us then allow some months for the manufacture of the items.To then ship the order out to Sydney would take another 100 days sailing the Clipper route via the Roaring Forties (the Cutty Sark held the record for this leg at 72 days). However, an extra 3 weeks would need to be allowed should a vessel became caught in the Doldrums. It would be quicker to ship them on a steamship but much more expensive. The ordered items would most likely be unloaded in Sydney and then have to be transferred to one of the Illawarra Steam Navigation Company's vessels to bring them down the coast. All up, we could assume some 10 months would be the minimum time to allow for an order to and from Birmingham in England!!!

• Over on the mainland, development was mainly around the settlement of Wagonga, at the western end of Wagonga Inlet, where timber and rural industries dispatched and received their goods. Most supplies and materials came from Sydney by boat, as the roads were primitive with many creek and river crossings.

• Wagonga Heads, later to become "Noorooma" then "Narooma", did not really develop until a sawmill was established near the heads in 1882 and by 1889 had its own Post Office, well after completion of the light. Therefore local support of any kind for Jennings would have been very limited.

SOME ASPECTS OF CONSTRUCTION:

EMPLOYEES:

Jennings' work at Montague was finished in 14 months, 4 months ahead of schedule, partly due to good weather for transporting supplies and for building, but mainly due to his excellent management of the project.
In those days work was labour-intensive, with a large number of men forming the construction team, from skilled artisans and tradesmen such as stonemasons, blacksmiths, carpenters, joiners, plasterers and builders to the project team of surveyors, engineers and supervisors. Each team would have its own hierarchy of management within its ranks.

The Moruya Examiner reported:
"Every available piece of level ground is occupied by masons, carpenters, plasterers, plumbers, blacksmiths and their assistants".

No detailed record of the numbers of workers on Montague has been found, however Jennings and his foreman Mr Yates were involved as contractors from 1885 in the construction of the impressive Catholic Seminary in Manly NSW. Some details of the workforce there, particularly the stone workers, are available in the publicity surrounding industrial action taking place on the Seminary site.

In a "Letter to the Editor" in the Daily Telegraph on 12 February 1886, Mr Jennings reports there were "42 cutters, 2 setters, 4 wallers, six scabblers, seven shoddy masons and five boys" employed at the Manly site.

We can then extend the list to include all the other workers required for the tower and the houses:
carpenters, bricklayers, plasterers, plumbers, blacksmiths, cabinetmakers, tilers, painters, labourers and others.

Without documentation it may never be known, but it is perhaps reasonable to assume Jennings employed more than 40 persons for the Montague project, with the number perhaps being more than this at times as different phases of the project were commenced and completed.

WE SUGGEST YOU NOW WALK DOWN TO THE QUARRY SITE TO EXPLORE THE WORLD OF GRANITE……

THE QUARRY

A recent article in a Quarry Journal referred to Montague's quarry as a "one-rock quarry".

LOOK…

As you can see the northern end of the large granite "tor" has been fractured unevenly, indicating the possible use of blasting powder to initially break it down.

LOOK…

There are piles of rubble ("grout "in quarry terms) nearby. If you look carefully these piles include some near-finished blocks, abandoned where they lay - whether from being faulty in some way or being surplus to needs.

LOOK…

Climb up a little and examine the lower of the two extensive "bores" or "drill" marks in the quarry face. You'll see that it is not round but almost triangular in shape and is surprisingly large.

LOOK… FEEL...

In some of the rubble and along the top of the quarry face you can see evidence of more "drill" marks.

A feature of Montague's granite is the large size of the crystals of mica and feldspar – an indication of the slow cooling period of this rock. These crystals are especially visible in the shattered face of the quarry if the sun is out.

IMAGINE…

This site would have been a busy place in Jennings' time… imagine the clink of hammers on chisels, the shouts of men, the grunts as heavy blocks were lifted, the cursing when things went wrong…

WORKING THE ROCK

Montague Island is the remnant of a parasitic vent on the side of an ancient, much larger volcano. The main volcano can be seen to the west – Gulaga (Mt Dromedary) – with the smaller Nadjanuka (Little Dromedary) to the south being another vent.

The southern end of the Island, as with Mount Dromedary is an "igneous intrusion of upper Cretaceous age" (around 94 million years old).

Any overlying Ordovician sediments have eroded over millions of years, subsequently exposing what is now the visual group of the big mountain, the little mountain and the Island.

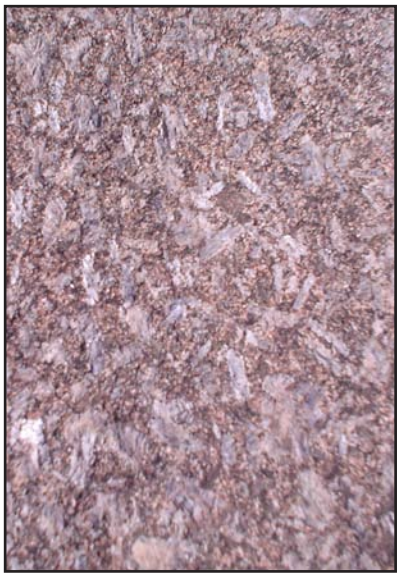
The three features are formed of a complex of related rock types, generally referred to as MONZONITE that has weathered to produce massive and spectacular tors. A cover of dunal sand provides the soils around the Island.

Monzonite is a dark grey, coarse-grained, rather micaceous rock (ie. consisting of, containing, or resembling mica), composed of plagioclase (feldspar) grains set in plates of alkali feldspar, and variable amounts of biotite, hornblende, pyroxene, opaques and trace amounts of quartz.

In layperson's terms, it is basically a granite-type rock, with much less quartz than more common granite forms.

We'll refer to it as granite during this text.

The Island's granite is dense, hard and heavy, making it a durable building material.



MASONRY WORKERS:

Stone Masons for larger jobs were actually a team made up of specialists in particular masonry skills.
"Cutters" (now known as banker masons) would have been responsible for the cutting of the blocks for the tower after blasting had occurred. This requires "drilling" of closely spaced holes along the lines of the proposed cut.

After boring the holes, iron wedges and shims would be inserted for driving in with hammers. The Cutters would listen to the sound of the wedges as they are struck with the hammer, waiting for the right sound which would indicate the rock is about to split. They would pause for a few minutes, to wait for the split, or if not, continue striking just one of the wedges until the moment is reached.

The blocks are then passed on to the "Scabblers", who used a hardened punch-like tool and hammer to chip off the rough bits around the block, giving it a textured surface. They would use a rule and a square to ensure the surfaces were true. A Scutch may also have been used, which is similar to a toothed cold chisel. When completed the block would be laid out and marked with others in its row in the tower.

The blocks would be transported to the tower and the "Setters" (now known as fixing masons) would take over for the placement of the block in the tower.

"Shoddy Masons" is an old term for masonry workers without qualifications who would be paid less than qualified persons. This would include apprentices.

MASONRY TOOLS

Blacksmiths would keep these tools sharp and hardened for the tradesmen.
Tools may have included:
Aberdeen Picks; Stone Axes; Large Dressing Hammers from 25 to 30 lb. weight; Larger Dressing Hammers from 17 to 19 lb.; Small Dressing Hammers from 6 to 8 lb.; Free Stone Picks; Large Quarry Mells [heavy hammer] 20 lb.; Jumpers [long iron drills used in quarries]; Small Hand Punches; Quarry Wedges; Boring Hammers; Large Pinch Bars; Rifting Hammers.
(this information is based on the Bell Rock Lighthouse)

SHAPING THE BLOCKS - "DRILLING" or "BORING"

To cut the rock into block shapes, the Head Quarryman would mark out suitable blocks, reading the "grain" of the granite for the best direction to cut, and then mark a series of holes to be bored. The Cutters would then take over.

The process of cutting smooth faces using a line of wedges and shims is sometimes known as "feathering".

The work is either "single-hand" or "double-hand". In single-hand drilling, the operator wields the hammer with one hand and with the other holds the drill or bit, rotating it slightly after every blow in order to keep the hole round and prevent the drill from wedging fast. This technique would have been used for roughing out the blocks once they were cut to a usable size.

Wedges and shims in place

In double-hand work (two-man team), one man strikes, while the other holds and rotates the drill – most likely used for the large drills in the quarry face.
A drill is a steel bar, generally octagonal in cross-section, one end of which is forged out to a cutting edge. The edge of the drill is made either straight like that of a chisel, or with a convex curve, this shape being better for very hard rock such as Montague granite.

A little water is poured into the hole at intervals to keep the cutting edge of the drill cool and make a thin mud of the cuttings.
From time to time, the hole is cleaned out by the scraper or spoon.

Another method of drilling is to use a "jumper". The jumper is a long steel bar, with the cutting edge as described, and is raised alternately and dropped in the hole by one or two men. On Montague, this technique may have been used for the deep bores in the quarry face.

For hard rock, such as Montague's granite, double-hand drilling may have been essential to secure a reasonable speed of work.

FEEL...
One of the bore holes... amazingly smooth.

A SLIGHT DIVERSION....

The following quotation from America is of interest on the subject of hand drilling in rock:

"In hard ground, in the days before machine drilling, a two-man team - one wielding the hammer and another turning the borer - might take 3 hours or more to drive a hole twenty inches deep, using a dozen or more steels. With the quality of metal then available a borer might last twenty minutes at most before it became too dulled for further use and had to be set aside to be re-forged."

Hand-boring contests were held in many mining and quarry areas around the world as a form of entertainment and for competitive reasons:

"The exceptional speeds, attained in hand boring contests held from time to time, bore no relation to normal quarrying. In one such contest attended by 1,000 people in August 1888, five teams competed and a Tincroft 'pare' (i.e. a group of miners who worked together) bored 13" in hard granite in under seven minutes, at a striking rate (with hammers slung full circle) at 91 per minute."

WE SUGGEST YOU CONTINUE THIS PART OF THE TOUR NEAR THE TOWER DOOR.

FEEL…

As you run your hands over the tower's wall, you can feel the individual marks left by the scrabblers as a kind of "signature" - a lasting tribute to those tradesmen who worked on the tower.

THE BLOCKS

Granite has a density such that it weighs 2600kg per cubic metre (162 pounds per cubic foot). We can estimate a typical block's weight at somewhere around 1300kgs to 1800kgs. Heavy indeed!

LOOK… 

The largest and thickest block in the tower may well be the lintel block above the door. It is perhaps at least twice, if not more, the size of surrounding blocks. It could thus weigh upwards of 4000 or even 5000 kilograms!

LOOK… 

The tower tapers on the outside, but the inside is a perfect 11 foot (3.3m) cylinder. Blocks at the base are well over a metre thick.

Montague's tower is not subject to the forces of wave action, so it is therefore unlikely the blocks needed to be keyed into each other. Their own mass would hold them firmly in place, with the weight of subsequent courses sealing their position forever.

However, the overhanging blocks towards the top would quite possibly need some form of "keying" into position.

Special blocks such as those involved with windows, or the "lintel" block above the doorway would all require extra working and planning for their cutting.

Each block would need to be finished with very flat upper and lower surfaces, as any curving inward would result in chips flaking off the sides of the block as courses were added above, and any curve outwards would affect stability and the forces on the blocks above and below.

In lighthouses subject to wave action, the blocks were not only keyed into each other on their sides, special "dowels" or "trenails" were placed into holes in the top and bottom of blocks which would effectively connect all the courses.

FORMING THE BLOCKS INTO ROWS OR COURSES

No two blocks within the tower are identical. Each row is made up of a differing number of blocks.

As courses were laid, the height of each row would be determined, and the width of individual blocks would then be governed by the size of the quarried stone available.

The Head Quarryman would chalk out blocks to match the row, finally ending with a complete circle of the required diameter.

These rows would be assembled on the ground near the quarry, marked with chalk before being transported to the tower site for lifting into place.

MOVING THE BLOCKS

No details were kept of how this was achieved on Montague, however we can make an educated guess from construction methods of the time.

One transport method employed wooden rollers under a sledge-like base that supported the stone.

Granite equipment suppliers were still selling wooden rollers well into the twentieth century - one advertising hardwood rollers up to twelve inches in diameter.

Several workmen were assigned to moving rollers from the back to the front as the stone moved along. For muddy conditions, wooden planks were placed on the track for the rollers to run on.

Or... perhaps Jennings constructed a small tramway with the carriage pulled up to the site using a windlass or a winch?

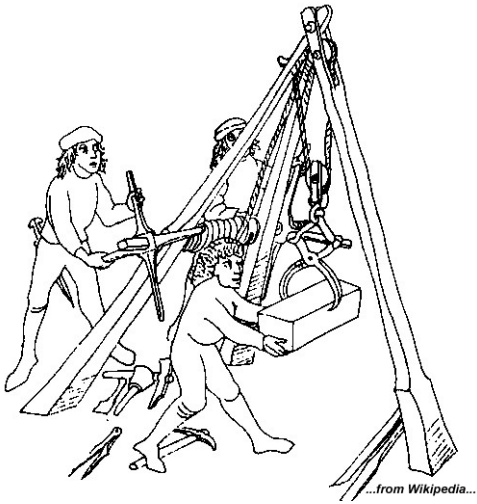
For the last haul up to the tower's base, a block and tackle may have been used, or perhaps Jennings constructed a derrick or crane to do the work.

LIFTING THE BLOCKS

LOOK AND FEEL…

Each block has a small “nick” in the centre-top outer edge, indicating the use of masonry “scissors” to lift them at some point during their journey to their place in the tower.

The External Lewis, Kerb Lifter or Slab Lifter (or “scissors”) is a type of lifting device used in the stonemasonry trade since Medieval times.



The External Lewis was shaped like a pair of scissor-tongs, and swung from a hand operated windlass or derrick.

Blocks would be lifted and placed in their position directly onto those below.

It is most likely the tower was built from the “inside out”, using the central cylinder as the means to hoist the blocks up to their final position.

COMPLETING THE STONEWORK

As each course was laid, cement mortar was used to “point up” the blocks. This seals them from water and wind, but serves no holding purpose.

ASSEMBLING THE FITTINGS

Once the stonework was complete, the inner fittings would have been assembled and progressively placed into position.
Chance Brothers shipped the fittings to NSW with them packed in such a way as to both protect them and allow for assembly in a far away place. Pieces were itemised and numbered. Indeed, you can still see the numbers stamped into the gunmetal of the balcony railing!

RECENT WORK - THE JOB GOES ON....

In 2007 the lighthouse had its cement pointing removed and then replaced to maintain it as a protection against water entering the tower. The work was commissioned by Australian Maritime Safety Authority and carried out by contractors from Australian Maritime Services.

COMPLETE THE TOUR BY WALKING AROUND TO THE BOULDER BEHIND THE SOLAR PANELS

(Please do not go near there if terns or gulls are nesting in spring)

LOOK…

Just behind the smallest solar panel can be seen the tool marks of some quarrying. Reports indicate that this is the spot from which granite was quarried for use by James Barnet in the GPO in Martin Place, Sydney.

LOOK…

Further round the large "tor" which the lighthouse sits on, just south of the tower, is another fractured quarry face. This is the place Musson chose to try blasting, cracking the tor and causing the "position of the tower to be altered several feet".

IMAGINE…

What would have been said by Musson and Company when they realised what they had done?

Perhaps to finish it is worth spending a moment to ponder on the light's future as a lasting monument to those involved in its planning, design, and construction. Will it still be standing in another 100 years? 500 years? It's granite is certainly capable of lasting as long as society will allow it to stand here on this Island.

YOUR EXPLORATION OF THE BUILDING OF MONTAGUE'S LIGHT IS NOW COMPLETED….

We hope you've enjoyed this glimpse into the past.

We welcome feedback and constructive suggestions to improve our self-guided experiences.

www.montagueisland.com.au

Sources:

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"The Lure of Montague", revised edition 2001, by Laurelle Pacey,
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This book is available for purchase in the Narooma Visitors Centre.

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findarticles.com (search for granite quarry)

People:

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