Bowen's Landing Historic Site, Risdon. Geology, building materials, survey factors and recommendations for geophysical work.

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Abstract

Permian siltstone and Tertiary basalt are the commonest materials around Bowen's landing site at Risdon and although not easily shaped or used have formed the basis for building foundations. Triassic freestone which has been transported up to a kilometre was used extensively for Bowen's house.

The exact location of much of the settlement remains uncertain due to doubt about the north orientation of Meehan's 1803 survey. However, the basic layout is known and selective application of magnetic, resistivity and seismic surveys is recommended for location of gardens, hearths and other buried structures.

INTRODUCTION

An archaeological investigation of the original landing site and township has begun at Risdon under the auspices of the National Parks and Wildlife Service. Other workers and departments have provided reports on the history of the site (Glover, 1977), vegetation, soils (Gray, 1978) and previous land surveys. This report completes the file of background data relevant to the site and its excavation by providing descriptions of the geology of the area, building materials, geological factors affecting previous land surveys and recommendations for the selective use of geophysics for location of building foundations in particular. An evaluation of rock types and their distribution is essential to any survey of sources of materials. Associated landforms may also provide clues to quarries.

GEOLOGY

Two previous geological reports are available which provide an outline of the geology and structure around Risdon (Moore, 1965; Leaman, 1976). Both are general and at quite small scales. Figure 1 presents a large scale map based on currently visible outcrops. Certain portions of the map are vague due to decades of agriculture. Eight materials occur within about 600 m of the landing steps.

Siltstone and siltstone talus

This is the most frequently observed material at Risdon. It dominates the hills south of the stream and is exposed over most of the region north and west of the steps as well as on the steep slope overlooking the brook. When fresh it is an even grey in colour but is normally found in a weathered condition. It is then either white, cream, yellow or speckled orange in colour. The siltstone, which is Permian in age and belongs to the Ferntree Formation is quite uniform in texture and grainsize. It often appears cherty and even glassy in appearance. No coarse units have been observed in outcrop although some pebbly fragments have been seen. Rare rock fragments have been seen in some exposures. The rock is hard, flinty and very difficult to work but when exposed in suitable faces it may be removed in regular blocks due to strong orthogonal jointing.

Where slopes are steep a soil-covered talus fan is commonly developed and this tends to smooth the abrupt, cliffy profile often seen in siltstone

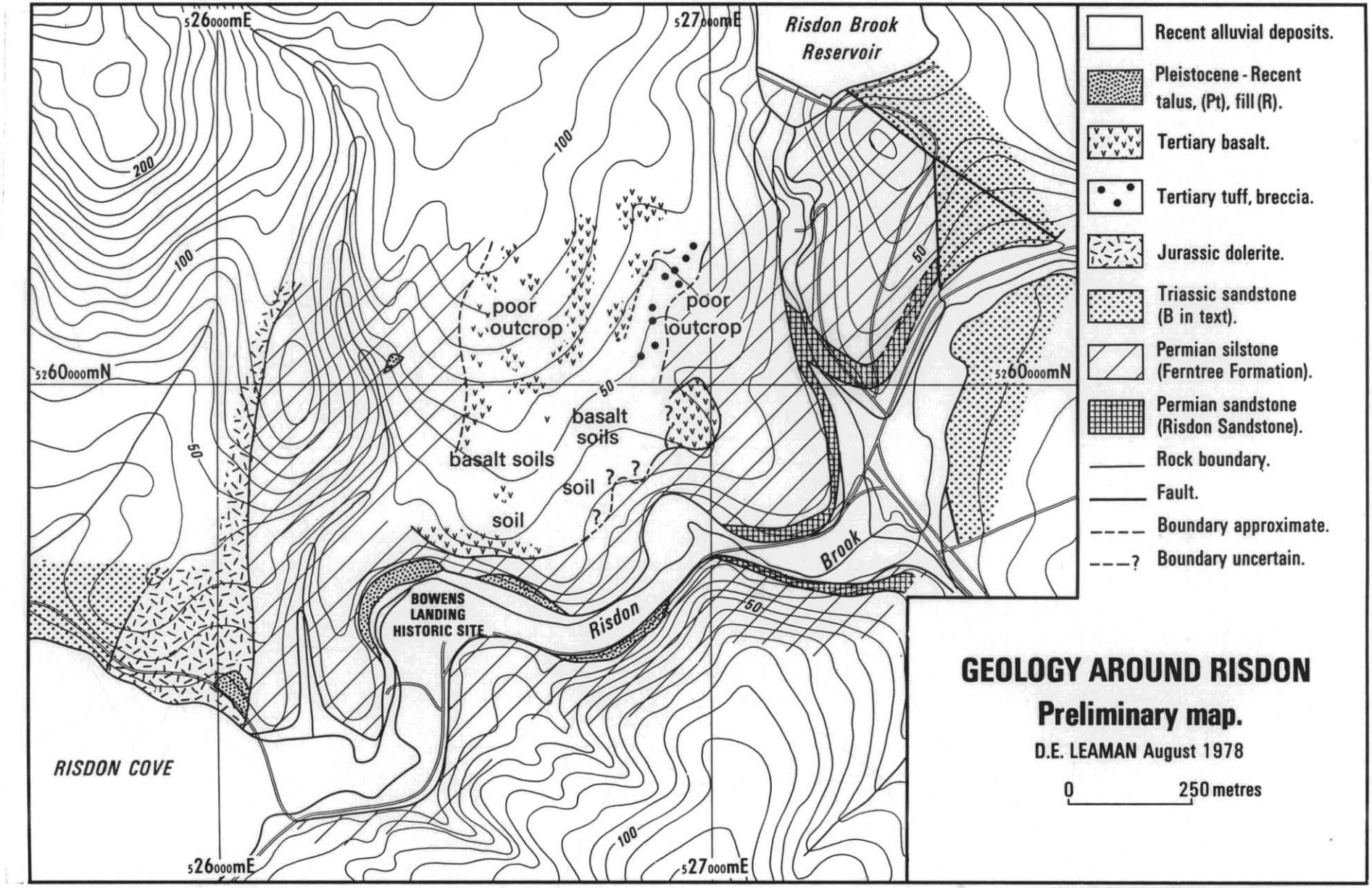
526000mE
527000mE
Risdon Brook Reservoir
5260000mN
poor outcrop
poor outcrop
basalt soils
basalt soils
soil
soil
BOWENS LANDING HISTORIC SITE
Risdon Brook
RISDON COVE
200
100
50
Recent alluvial deposits.
Pleistocene - Recent talus, (Pt), fill (R).
Tertiary basalt.
Tertiary tuff, breccia.
Jurassic dolerite.
Triassic sandstone (B in text).
Permian silstone (Ferntree Formation).
Permian sandstone (Risdon Sandstone).
Rock boundary.
Fault.
Boundary approximate.
Boundary uncertain.
GEOLOGY AROUND RISDON
Preliminary map.
D.E. LEAMAN August 1978
0 250 metres
5 cm

Figure 1.

areas. The lower part of the slope near the monument is composed of talus. The normal siltsone talus consists of a random jumble of various sized angular pieces with a variable amount of matrix fill - soil and sand size fragments.

No distinctive local variations have been noted in this material.

Basalt and tuff

Basalt is the next most common material but it is poorly exposed. The thickest soils, and those which have been most utilised, are developed on the basalt. These soils have crept downslope and probably conceal siltstone at shallow depth in the areas marked 'soils' on the map. It is not possible to give an accurate indication of basalt boundaries on the basis of geological mapping alone. The source of basalt is high on the hill and the basalt has flowed downslope from it. The volcanic vent is not well exposed but part of the cone of the volcano is indicated by the tuffs and crystal tuffs in that part of the area nearest the Risdon Brook Dam Reserve.

Fine-grained basal remnants of the flows are exposed on the knolls overlooking the road interchange in the east, and the monument in the west.

The deposits of tuff appear fragmental and discontinuous and a number of springs are related to them. In the same general areas the basalt itself is variable; ranging from black and massive to dark grey and pumiceous. Most outcrops are black and vesicular.

As a result of groundwater confinement, flow restrictions and other effects the eastward facing slope is hummocky and irregular suggesting numerous small landslides, slope failure and creep.

The basalt is Tertiary in age, not Triassic as mentioned by Gray (1978).

Dolerite

Jurassic dolerite forms a western wall to the area. It cuts off the Permian siltstone succession and in the immediate vicinity of Risdon Cove narrows to a faulted near-vertical dyke about 200 m wide. It is well exposed in road cuttings north of the short causeway across Risdon Brook.

Alluvial deposits

Recent alluvial deposits fill the valley floor of Risdon Brook. A variable amount - up to one metre - of dark soil which often contains small rock fragments overlies a sandy clay base. No thick sections are available for inspection and no estimate of total thickness is possible. The lowest material is a pure clay in several places but even this quite often contains distinct grit or pebble beds. Each embankment exposure yields evidence of a complex alluvial history of reworking, deposition and erosion. As a result many gravel bands are discontinuous. At the landing steps a thin band of sandstone pebbles was cut off by a more recent channel which had itself been re-filled.

Sandstone A

A five metre bed of coarse, gritty, dirty-looking feldspathic sandstone is exposed at the base of the Ferntree Formation siltstone immediately west of the Risdon road interchange near Risdon Tavern. It may be seen on both banks of the brook, in the brook and is very well exposed by the road-

side. When fresh it is white to light grey in colour but contains pebbles and rock fragments up to 100 mm across. It often weathers to a dingy green colour. Due to relatively poor cementing and coarse grain it does not work easily.

Sandstone B

The much used Triassic freestone is exposed west of the dolerite dyke at Risdon Cove. Thick beds of quartz sandstone may be seen on the river shore south of the Bailey Bridge. It is very free working and much finer than the Permian sandstone (A). It is much more evenly grained and contains rare clay pellets only. When fresh it is white to grey in colour but normally weathers to a uniform buff. Poorer exposures are found 200 m beyond the road interchange toward Grasstree Hill.

BUILDING MATERIALS

At the time of writing few building sites are available for examination. Those which may definitely be related to Bowen's settlement by the 1803 survey of Meehan are the landing steps, the store behind the monument, Wilson's house above the store, Bowen's house, possibly Moore's new house and retaining walls of various ages.

At the landing stage most stones are large siltstone blocks. The natural tendency of this material to break into large rectangular, or sub-rectangular, pieces with flattish surfaces has been much utilised. It is the dominant material. Some blocks are large but could have been derived from the bench at the top of the slope just west of the monument. Both sandstones are represented. Sandstone A occurs as irregular filling pieces although two are quite large. The freestone is more common and some blocks have been shaped. Occasional basalt blocks are also present.

A sizeable portion of the store has been exposed and nearly every stone used in its contruction is siltstone. Some brick is present and a little basalt. The pieces are of irregular sizes. The excavation has also revealed a good section of some more recent talus fill above the original earthen floor.

Wilson's hut, partway up the slope above the monument, was built on foundations of siltstone. Even the fireplace is of siltstone.

Bowen's house high on the slope overlooking Risdon Cove is much more interesting. The ruins here appear to be in two parts with the eastern part extending to the old fence line and a size of about 33 x 44 links (6.6 x 8.8 m). The western part with a slightly more northward orientation is 28 links (5.6 m) away and has a size of about 45 x 45 links (9 x 9 m). There is a porch/step base about 6 links (1.2 m) wide. The parts may suggest a total structure which is slightly 'L' shaped and 117 links (23.4 m) long by 33 - 45 links (6.6 - 9 m) wide. The western portion of the foundations are made up mostly of unshaped basalt blocks and pieces of siltstone. The fissility of the siltstone has been used to provide reasonable planar wall surfaces. Some pieces of brick are present, there are very few fragments of sandstone A but several pieces of sandstone B are present and indicate shaping. In the eastern half of the building the situation is quite different. There is a much higher proportion of sandstone (nearly all type B) and it has been shaped. Some pieces are quite large (700 x 500 x 400 mm). Pieces of siltstone of similar size are also present. Basalt pieces are relatively rare. All walls are about 500 mm thick and mortared.

Moore's new house in believed to be immediately north of the ruins of

Gregson's house on the knoll overlooking the brook and adjacent to the old Richmond road. Most of the debris in this area is of siltstone and brick although several pieces of worked freestone are present. It is uncertain how old these structures are or whether they post date the settlement by many years.

A number of pieces of worked freestone formed into large rectangular blocks have been found in the large field between Bowen's house and Gregson's. It is possible that Gregson quarried the houses of both Moore and Bowen.

Several retaining walls can be seen in the area. Most are to be found along the route of the original Richmond road. Another is to be seen at the banks of Risdon Brook at the steps. Siltstone has been used extensively.

The preferred building material was siltstone due to its availability and naturally contolled shaping. No definite original sources can be found although a possible quarry and loading ramp occurs in a tributary valley about 300 m north of the monument. In the original settlement most material was probably derived locally wherever possible. The common basalt blocks have also been much used. Since the basalt is hard and does not shape well the rounded boulders have been used as found, wall surfaces being squared by filling or siltstone. The preferred sandstone was that of the Triassic (B) but the particular source is unknown. It is most readily available on the shore platform at Risdon Cove.

FACTORS AFFECTING PREVIOUS LAND SURVEYS

A surveyor was requested by Bowen and sent by Governor King. His survey was lost until recently and a recent interpretation has been made of his field notes by N. Ward of the Lands Department. The following discussion refers to this interpretation of the survey of James Meehan and as transcribed by Frank Bolt. If one assumes that -

(1) directions are specified by sense of the orientation,

(2) measurements are in chains and links,

(3) notes L, R mean left and right,

(4) little allowance was made for slope or catenary,

(5) the declination in 1803-1804 was 9°35'E,

then the present author also obtains an arrangement very similar to that offered by the Lands Department. The most important departure relates to item 4.6 in reference to the side, edge and end of the Governor's garden. The 366 link (73.2 m) edge must be drawn southward and not northward ('S7 1/4E').

The resultant map compares rather unevenly with Bowen's sketch map made two months previously when it is understood that the encampment was basically settled. Clearly Mr Mountgarret relinquished one of his properties to Lt Moore, less than 20 m from Gregson's subsequent structure. References by Gregson to the structure which was a '100 yard stroll' 'to the bottom of the garden' (Walker, 1902) (Glover 1977, p.35) possibly refers to that of either O'Brien or Barnes although no trace remains.

The assumptions listed above are crucial to the exact location of various sites even allowing for probable surveying errors. In general these seem to be minimal when tested by closures and where Meehan was able to utilise his theodolite fully. In other cases his notes suggest that many lines depend on azimuthal magnetic compass readings and presume a reliable base assumption. Item (4) is a potential source of error. Errors of one and three metres could be introduced in the links from the store to Wilson's house and store to station 2 respectively. Errors between O'Brien's and Reardon's huts could also be up to 2 m due to slope effects.

The most serious potential error relates to use of a value of magnetic variation. There are three reasons to doubt the value quoted by Meehan and Grimes in their 1804 journal for Risdon.

(1) Meehan is not noted for the accuracy of basic positional fixes. He quotes the latitude as 42°40' which is in error by nearly 9' whereas Flinders in 1798 recorded a value of 42°48'12". Flinders (1814) quotes magnetic variations of 8°28' (azimuthal compass) or 9°15' (theodolite) for the south side of Risdon Cove whilst noting instability of the results in the general area. Flinders is likely to have been a more reliable observer.

Although records are poor it is likely that the value was less than 9° in 1800. The value in 1863 was a peak 10°25' before reducing, surprisingly, to 8°49' in 1881. An estimate based on Bligh's Adventure Bay sightings after allowing for positional offset is less than 9° in 1792. Flinders in 1798 notes that 1-2° variations are common. Tasman in 1642 noted a value of 3°E for Frederick Henry Bay (Marion Bay) which if we allow for position and a regular variation overall to the present would yield values of 4° in 1675; 5° - 1704; 6° - 1735; 7° - 1767; 8° - 1798; 9° - 1830; 10° - 1862; 11° - 1893; 12° - 1923; 13° - 1956 at Risdon. This simplistic approach is not valid for the period 1863-1881 at least but the prediction for 1862 is close for all that. It does seem likely that if a magnetic base is used Flinders' 8°28' value is most reasonable and more reliable than Meehan's. This is further supported by Flinders (1814) map compilation which quotes a variation of 9°E in Storm Bay. This value, due to positional difference, should be at least 20-30' in excess of the value at Risdon.

(2) An additional problem astutely noted by Flinders relates to geologic interference. His measurements, like Meehan's, relate to the shores of Risdon Cove which is not a simple area magnetically. A magnetic survey (Leaman, 1977) has revealed strong magnetic gradients related to the dolerite dyke across the Cove from north-east to south-west. Various values of declination could be obtained depending on the exact position of the recording sites. The values would be increased above the correct value as a result. This would mean that Meehan's value of 9°25' and possibly Flinders' 8°25'E are both higher than the true value. The error could be as much as a degree in Flinders' case and two degrees in Meehan's.

(3) Stereographic examination of the oldest available large scale aerial photography (1946) failed to reveal much more than is visible on the ground except for three faintly discernable features occurring in the substantial cleared areas. The first is an approximately rectangular arrangement immediately north of the Gregson house bounded by trees in the west and hedge to the north. Its size is comparable to that of Moore's garden but its position is displaced northward by about 10-15 m.

A second lineament curls across the access road to the Gregson house and terminates near the hedge. Its form is that of the curled traverse from O'Brien's hut to Reardon's but is again displaced northward by a similar amount.

A third pair of linear markings can be seen in the middle of the large field south of Bowen's house. The position would approximate that of the south-west corner of his garden if it were 366 links deep and offset slightly. This set of three markings match the shapes surveyed by Meehan but the rotation is crucial. If the markings are indeed real and relate to paths, walls or garden edges then the discrepancy can only be accounted for if the magnetic variation to be used was 7-8° and not nearly 10°. A deviation of 2-3° could result in errors of 20-25 m in the placement of the propeties of Clarke, Burt and Mountgarret.

In addition there appear to be deficiencies in the measurements relating to the Governor's new house. As mentioned previously the structure appears to be in two parts. The author has made some rough estimates of the size and orientation of the structure and obtains 44L x 33W links and 45L x 45W links (plus 6 links for porch) for each part. Separation about 28 links. This is contrasted with Meehan's estimate of 66 x 27 1/2. Meehan quotes an orientation of W9 1/2N or more than W16N true (depending on variation value) whereas the front wall does not appear straight at present and has an orientation more than ten degrees less (est. at W 1 N). This is a very severe rotational error and the structure needs further examination. It is possible that the local basalt or a tool carried by Meehan could have caused such an error. If the former condition is the case then a variation map of the area will be required before the survey can be made reasonably reliable due to the long uncontrolled sets used.

GEOPHYSICAL WORK RECOMMENDED

Geophysical surveys may be directed at three aspects of the overall evaluation of the site.

(1) Provision of additional geological information. A detailed magnetic survey could locate the actual limit of the basalt and separate areas where only a soil cover is present. Seismic refraction surveys could provide estimates of soil thickness, thickness of alluvial fills, thickness of talus fans and locate old stream banks and deposits. Recent deposition near the landing steps might be estimated to yield an indication of the extent of the brook in 1803.

A magnetic survey, with 10 m line spacing, is recommended for the area marked 'soils' so that boundaries may be confirmed. Detailed refraction surveys are suggested within this area and near the landing stage as controls on estimates of deposit thickness and form.

(2) Evaluation of landforms. Some of the landforms east of Bowen's house are suggestive of either refilled quarries or failed slopes. The detailed rock profile will confirm which and magnetic and refraction profiles are suggested to this end.

(3) Location of buried foundations. It is possible, given adequate physical contrasts, to locate trenches, holes, walls if a sufficiently detailed array of magnetic and resistivity traverses is undertaken.

It is suggested that initial testing cover the area around the property of the blacksmith, Bowen's house and garden, and soldier cottages which are clear of the area sown for summer crops. If there is some success in these areas work should be extended to cover the main street which is currently a farmed area with deep soils.

Since much surveying will be required for the above surveys it is suggested that the known sites be tied into the survey and their size and orientation confirmed. These values will aid evaluation of Meehan's survey.

A further series of tests is recommended along the south side of Risdon Cove to evaluate the amount of magnetic variation induced by the dolerite dyke. Such tests would indicate whether errors of 3° could exist on this account.

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