

## Gravity survey at Stanley.

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## Abstract

A detailed gravity survey on and around The Nut at Stanley has shown that The Nut is a slab-like basalt body, with a circular feeder approximately 150-200 m in diameter located near the northern end. This is in agreement with Gill and Banks (1956) who suggested that it was the remnant of a volcanic neck.

## INTRODUCTION

Circular Head, or The Nut, at Stanley [CQ565860] is a rounded steep-sided monolith rising from sea level to a maximum height of 143 m. Although its igneous origin is clear, its precise manner of formation has not been clearly understood. Edwards (1941) described it as the remains of a small steep-sided basaltic laccolith intruded into Permo-Carboniferous sediments. Gill and Banks (1956) recognised the pyroclastic nature of deposits immediately north and south of The Nut and suggested that The Nut was the remnant of a volcanic neck intruded into tuffs, probably of Tertiary age. Cromer (1972) studied the petrology of The Nut and concluded, largely on the basis of a concomitant gravity survey, that The Nut was a basalt lava pond and that no significant feeder system was present.

As a result of detailed mapping in the area (fig. 1), it appeared that the volcanic neck origin was more likely than the other two alternatives. This was in conflict with the previous gravity survey (Cromer, 1972) which was restricted in coverage and control and could not be fully reduced with the requisite precision to resolve the problem. The survey had indicated that The Nut was not a massive pipe but was largely a basalt slab and that if any pipe was present, it was on the northern side of The Nut. The coverage was inadequate to confirm the suggestion of a pipe or to be certain, allowing for regional considerations, that the values recorded on The Nut itself were wholly representative. Except on the town side, they could not be related to values at the foot of The Nut.

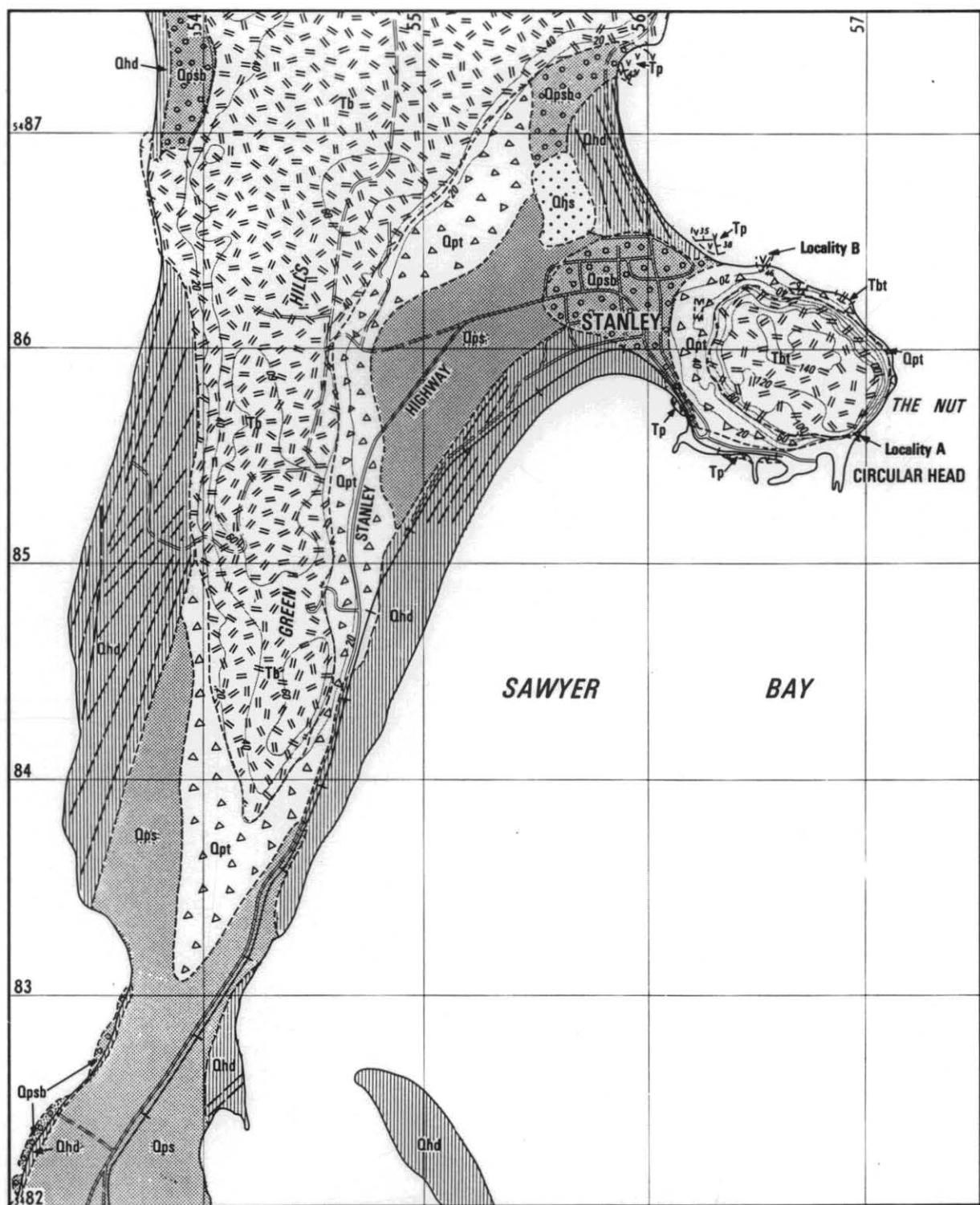
## PRESENT GRAVITY SURVEY

A more detailed gravity survey was undertaken in an attempt to locate the suggested feeder. The location of stations comprising the present survey and some of Cromer's extensions are shown on Figure 2. All stations on the top of The Nut (stations 1-57) were surveyed with an elevation accuracy of <50 mm. Stations 81-102 were surveyed from the high water mark datum (accuracy  $\pm 300$  mm). The elevation of the remaining stations were determined using a microbarometer and the high water mark datum. By using short loops, an elevation accuracy of <1 m is possible. All stations have been terrain corrected to a radius of 19 km.

The terrain correction calculations are the most significant source of error in the Bouguer anomalies (fig. 3). Comparative calculations suggest that the error nowhere exceeds  $10-20 \mu\text{m/s}^2$ . A Bouguer density of  $2.67 \text{ t/m}^3$  has been used in the reduction since this value is likely to approximate the local bedrock (Precambrian or Cambrian).

The Bouguer anomaly (fig. 3) shows three main features:

- (1) A regional trend of about  $20 \mu\text{m/s}^2/\text{km}$  from east to west.



### GEOLOGY OF CIRCULAR HEAD

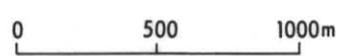
GEOLOGY BY P.W. BAILLIE

<p><b>HOLOCENE</b></p> <ul style="list-style-type: none"> <li> Swamp deposits.</li> <li> Dune and beach sands, beach ridges indicated where present.</li> <li> Basalt talus.</li> <li> Sand with basalt boulder beds of marine origin indicated.</li> </ul>	<p>PLEISTOCENE</p>	<p><b>TERTIARY</b></p> <ul style="list-style-type: none"> <li> Basalt (Tb), coarse grained teschenite (Tbt)</li> <li> Pyroclastics.</li> </ul>
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Road  
 Railway

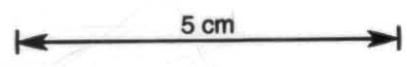
Contour interval 20 metres.

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Figure 1.



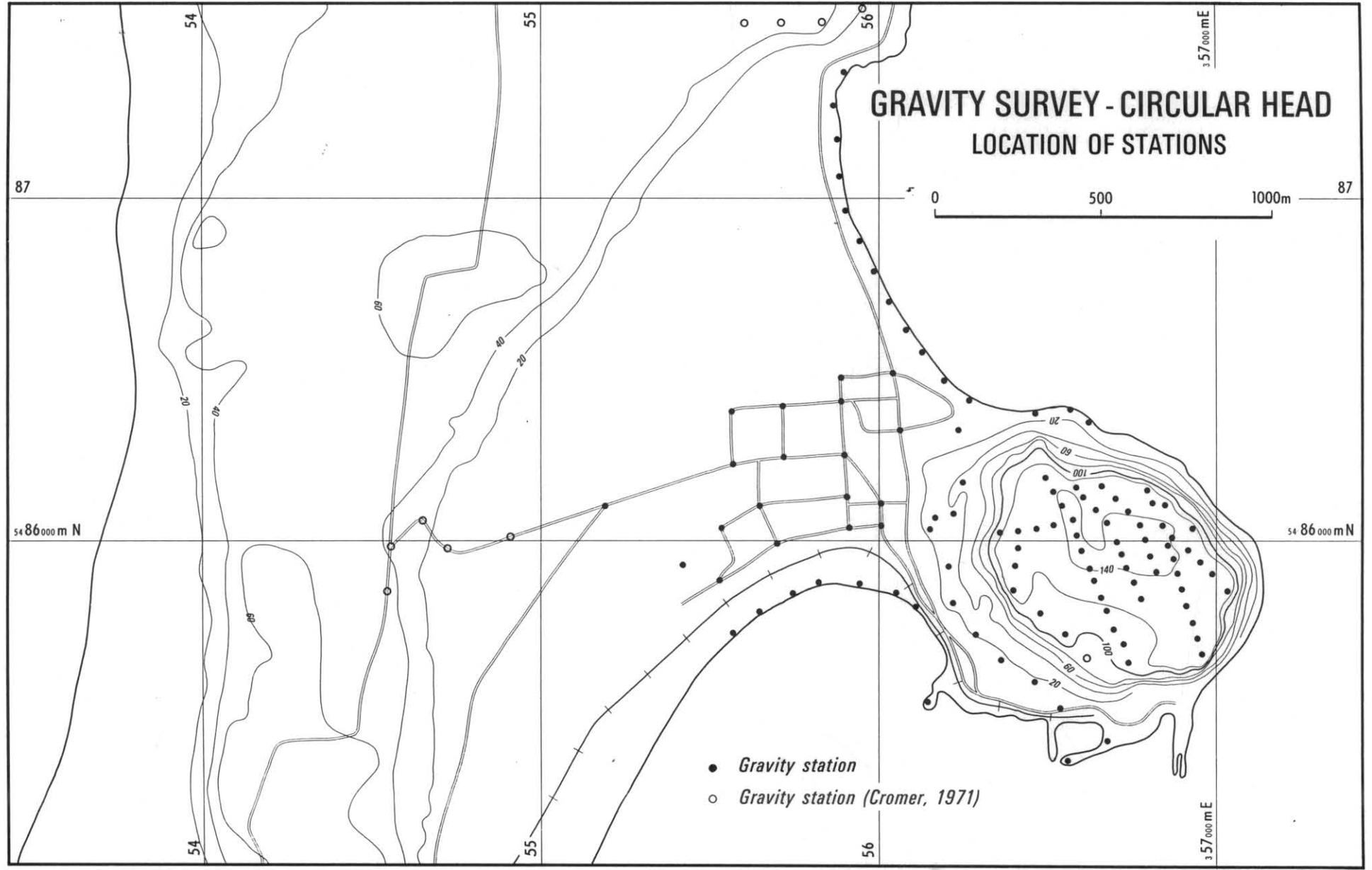


Figure 2.

5 cm

- (2) A restricted, closed anomaly of about  $30 \mu\text{m/s}^2$  relief on the northern end of The Nut.
- (3) An opening negative anomaly exceeding  $20 \mu\text{m/s}^2$  (allowing for the regional anomaly) in the wharf area.

The zero Bouguer anomaly contour, as it crosses the coast north and south of Stanley, represents less than 5 m of Quaternary deposits on bed-rock (Leaman, 1973).

#### DISCUSSION

If it is assumed that the basalt of The Nut has a density of  $2.9 \text{ t/m}^3$  and occurs as a slab to sea level, then the Bouguer anomaly reduces to that shown in Figure 4. This indicates the local deficiencies and excesses whilst still containing some regional component. Values west of and in the Stanley township and from the wharf area remain largely unaltered. This gives perspective to the closed positive anomaly and indicates that there is little basalt below sea level on the eastern section of The Nut. This is confirmed by a contact exposed in the base of a cliff 100 m north-east of the wharves (Locality A, fig. 1), where vesicular basalt overlies tuff with an irregular sub-horizontal contact. The vesicular basalt rapidly grades up into the coarse-grained rock that makes up the bulk of The Nut.

Two tongues of basalt can be recognised (fig. 4), the first off the north-eastern shore and the second around the south side of The Nut mass. These probably represent basalt fills in underlying pyroclastic material and cannot exceed 40-50 m in thickness. Since the assumption upon which Figure 4 is based (a horizontal basalt slab to sea level) is not true (the basalt cap is irregular in section), this circumstance only serves to reinforce the conclusion reached.

The negative anomalies around the southern side of The Nut reflect an increasing thickness of Tertiary pyroclastic material. If a density of  $2 \text{ t/m}^3$  is assumed, then about 10-15 m of material under the bulk of The Nut increases to at least 50 m south of The Nut. It seems likely from the gravity results that the bulk of the basalt mass of The Nut is underlain at shallow depth by bedrock. An agglomerate east of the cemetery (Locality B, fig. 1) contains abundant quartzite xenoliths 50-100 mm in diameter along with volcanic ejectamata. The quartzite appears to be identical with other quartzites of the Rocky Cape Group, suggesting that sediments of the Rocky Cape Group form the basement in the Stanley area.

The adjusted Bouguer anomaly map (fig. 4) shows the closed positive anomaly as being more symmetrical than it appeared from the Bouguer anomaly map (fig. 3). The presence of an infinite, approximately cylindrical pipe about 150 m in diameter is implied. The maximum possible size allowing for peak anomaly, near outcrop and density variations is 250 m. This is in strong agreement with the origin of The Nut being a volcanic vent.

#### REFERENCES

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- GILL, E.D.; BANKS, M.R. 1956. Cainozoic history of Mowbray Swamp and other areas of North-Western Tasmania. *Rec.Qn.Vict.Mus.* n.s. 6.

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[12 June 1978]

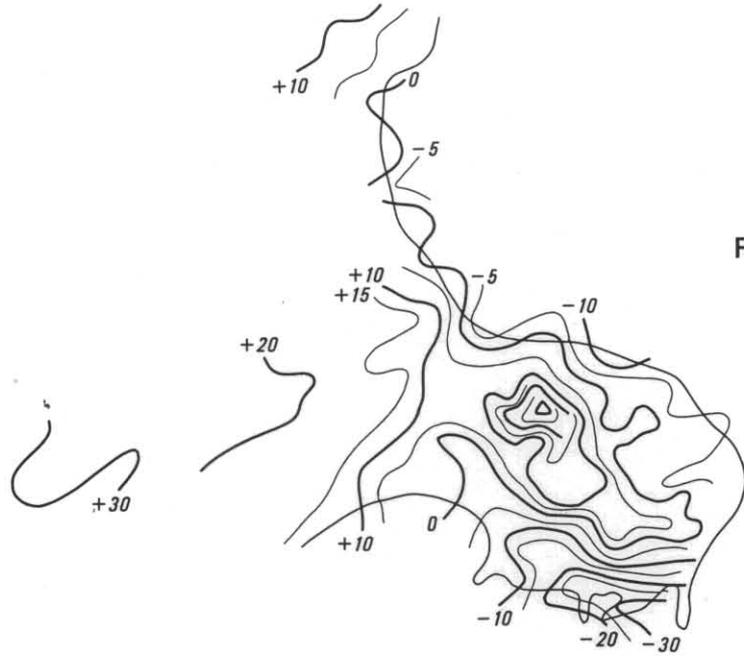


Figure 3

**BOUGUER ANOMALY**

2.67t/m<sup>3</sup>

CONTOUR INTERVAL - 5μm/s<sup>2</sup>

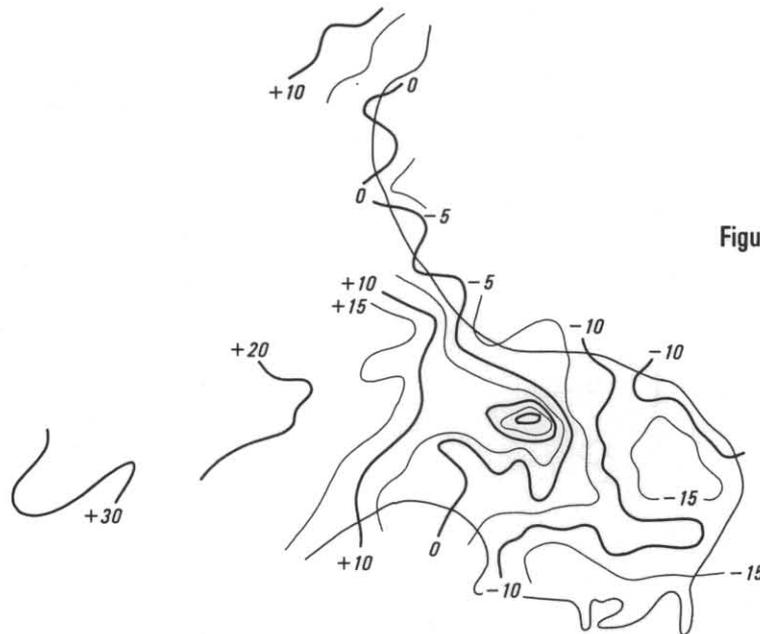


Figure 4

**BOUGUER ANOMALY ADJUSTED FOR NUT MASS**

DENSITY ASSUMED - 2.9t/m.

CONTOUR INTERVAL - 5μm/s<sup>2</sup>

