

## REVISION OF GRAVITY LINKS BETWEEN SOUTH AMERICA AND THE ANTARCTIC

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SINCE its inception in 1959, all gravity survey work within the Falkland Islands Dependencies and British Antarctic Territory has been carried out using Worden gravity meters (Griffiths and others, 1964). Whilst they are very suitable for establishing small networks and local survey work, these meters are subject to erratic drift and are therefore unsuitable for long journeys where intermediate checks are not possible. Since the assignment of absolute gravity values to the Antarctic Peninsula network can only be obtained at present by ties to the international system in South America, a check on the Worden connections was considered desirable.

In October 1964, the U.S. Navy Oceanographic Office kindly loaned LaCoste and Romberg geodetic gravity meter No. 2 for use during the 1964-65 Antarctic summer. This instrument had been calibrated in 1957 over the whole range of the scale by the manufacturers, and in 1963 the U.S. Navy carried out checks which revealed a change of  $+0.04$  per cent in the calibration factor. After the present work (in March 1965), the instrument was re-calibrated over a small part of the scale at the new U.K. Geological Survey standard stations in Cheshire (*Mem. geol. Surv. Summ. Prog.*, 1965 [for 1964], p. 84). The result for the line between Prees and Hatton Heath, which is virtually level, was  $0.02$  per cent less than the U.S. Navy calibration. The measurements on the line between the Cat and Fiddle Inn and North Rode, which involves a large height difference, gave a calibration factor  $0.21$  per cent lower than the U.S. Navy figure. The reason for this large discrepancy is not clear; all the pressure seals were replaced by the manufacturers immediately before the start of the Antarctic work, so pressure changes due to different station heights should have no effect. Also, measurements on the old calibration line, between Macclesfield and the Cat and Fiddle Inn, resulted in a figure which was only  $0.05$  per cent less than the U.S. Navy calibration. Since the gravity observations in the Antarctic were made within a few feet of sea-level, it has been assumed that the U.S. Navy calibration is substantially correct and can be applied to the results obtained.

A closed loop was measured between Punta Arenas, Deception Island, Port Stanley and Montevideo (Fig. 1). Two one-way connections were also made between Deception Island and Signy Island. Details of the station in Punta Arenas are given by Woollard and Rose (1963, station WH 1019). The location of the Signy Island station is shown in Fig 2. Details of the other stations are listed by Griffiths and others (1964). The Montevideo station had already been connected several times to the station at Ezeiza airport in Buenos Aires where the absolute value of gravity is known. The gravity difference between Montevideo and Punta Arenas can therefore be assumed from the published information. The other sides of the circuit are all one-way measurements with the LaCoste and Romberg instrument. Drift was extracted by applying the gravity meter's characteristic drift rate ( $+0.024$  mgal/day), which was determined during the course of local work throughout the season.

Fig. 1a shows the drift-corrected measurements (in mgal) for the closed loop before adjustment for closing error. Fig. 1b shows the same network after the closing error had been distributed around the three measured sides of the circuit in proportion to the sizes of the gravity differences. The values in brackets with their standard errors are derived from the previous determinations (Griffiths and others, 1964, fig. 2).

The revision of the link between Port Stanley and Deception Island also necessitates adjustment of the base-link diagram shown in Fig. 3a. Here, the differences between Port Stanley and Deception Island, and between Deception Island and Signy Island are derived from measurements with the LaCoste and Romberg instrument. The values in brackets are based on the diagram of differences before correction for closing error by Griffiths and others (1964, fig. 1,\*

\* Since the publication of these original base-link diagrams, the base station at Signy Island has been changed because of demolition of the old site. The value of gravity at the new station is  $0.2$  mgal less than at the old one. This information was received in time to alter the base-station value given by Griffiths and others (1964, table III) but adjustment of the base-link diagrams (figs. 1 and 2) and modification of the station-location diagram (fig. 8) were omitted. The figures shown in brackets in Figs. 3a and b for the gravity differences between South Georgia and Signy Island, and between Deception Island and Signy Island have been corrected to the new station at Signy Island.

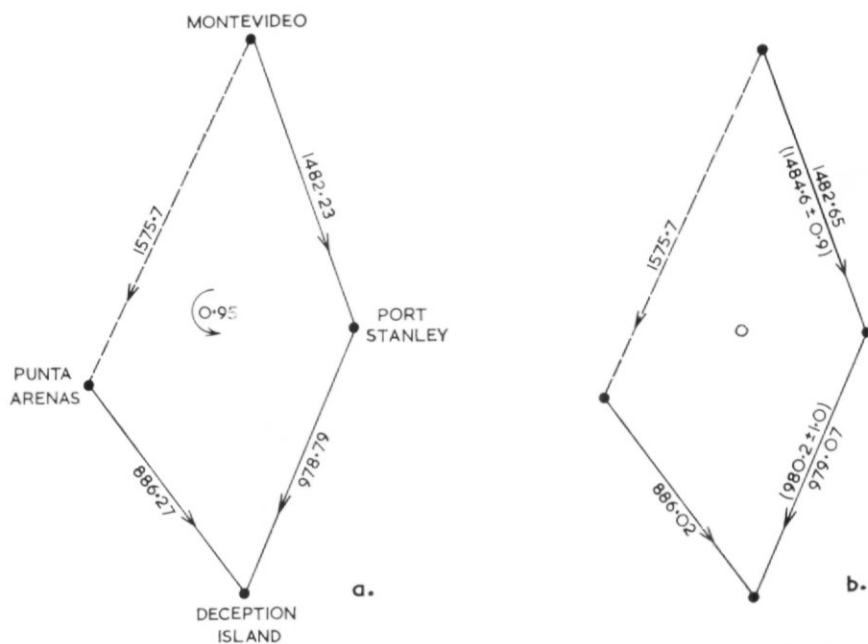


Fig. 1. Network of gravity base stations between South America and British Antarctic Territory. Station differences are given in mgal.

- a. Before distribution of the closing error.  
 b. After distribution of the closing error.

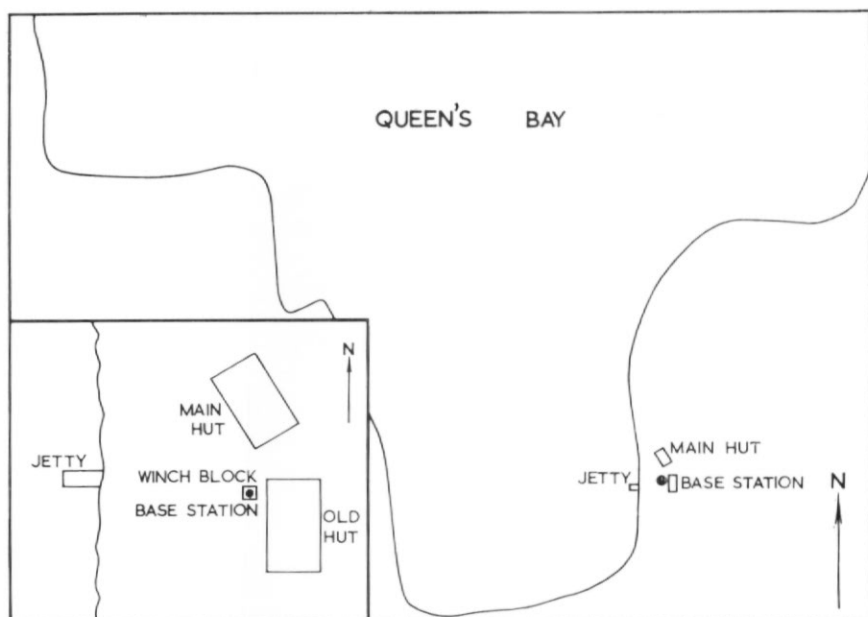


Fig. 2. Location of the gravity base station at Signy Island, South Orkney Islands. The station is on the winch block in front of the old hut, and it is marked by a brass plate.

p. 7). In reducing the closing error, it was assumed that the links with the LaCoste and Romberg gravity meter are correct. The error was then distributed between the other two sides in proportion to the sizes of the standard errors of the Worden determinations. The corrected base-link diagram is shown in Fig. 3b.

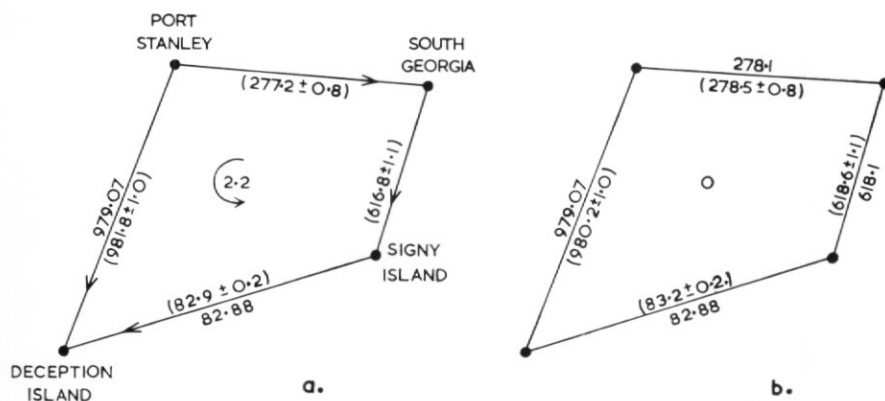


Fig. 3. Network of gravity base stations in the Falkland Islands, Falkland Islands Dependencies and British Antarctic Territory.

- Before distribution of the closing error.
- After distribution of the closing error.

Table I gives the revised absolute gravity values of the major base stations, and they are compared with the previous values.

TABLE I. COMPARISON OF ABSOLUTE GRAVITY VALUES  
(Gravity values in cm. sec.<sup>-2</sup>)

Locality	Revised Values	Values given by Griffiths and others (1964, table III)
Punta Arenas	981.3363*	—
Montevideo	979.7606	979.7606
Port Stanley	981.2433	981.2452
Deception Island	982.2223	982.2254
Signy Island	982.1394	982.1422
South Georgia	981.5213	981.5237
Zavodovski Island	981.8443	981.8467

\* Station WH 1019 (Woollard and Rose, 1963).

Absolute gravity values of all other base stations and all local stations in the Antarctic Peninsula and the South Shetland Islands listed by Griffiths and others (1964) should be decreased by 3.1 mgal, because of the revised links. Absolute gravity values of local stations elsewhere should be adjusted in accordance with the change in the base station for the area. Thus, all stations on South Georgia and the South Sandwich Islands must be decreased by 2.4 mgal and all those on the South Orkney Islands must be decreased by 3.0 mgal. The latter correction also allows for the discrepancy between the old and new base stations at Signy Island.

## ACKNOWLEDGEMENTS

I wish to thank the U.S. Navy Oceanographic Office for the loan of the gravity meter and Messrs LaCoste and Romberg Inc. for their speedy and efficient overhaul of the instrument before the season's work. My thanks are also due to Dr. W. Bullerwell for information and advice regarding the calibration of the gravity meter.

*MS. received 2 August 1965*

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