E. A. GLENNIE

THE PRESENTATION OF GRAVITY OBSERVATION RESULTS

The development of gravimeters has made relative gravity observations very quick and accurate. Though the pendulum has not been discarded and still has an important role in gravity work, yet it is a fact that, from now on, there will be far more gravimeter stations of observation, than there will be pendulum stations. All this gravimeter work, and a great deal that has already been done, could provide data of the greatest value to geodesists. Unless some steps are taken to record them for geodetic purposes, these data will remain locked up in files, and daily become more inaccessible.

It is the purpose of this paper to draw attention to this situation.

In Geodesy and general Geophysics, the use of gravity data is mainly to determine the Geoid, the Figure of the Earth, and the Structure and Topography of the deeper layers fo the crust.

In geological exploration, search is being made for minerals and structures relatively close to the surface, and the spacing of gravimetric stations is correspondingly close. When a sufficiently wide area has been covered, the results are examined and certain broad gravity trends are noted. These are assumed to be due to structures too deep to be useful, and empirical methods are used to remove their effects from the gravity data.

Now it is precisely with these regional trends that the geodesist is primarily concerned. He is not specially interested in the final geological results which emphasize the effects of structures at a small depth. Therefore he does not require all the unwieldy mass of data from the very closely spaced gravimetric stations.

Briefly, it can be said, that the geologist, concerned with mineral exploitation, is interested in the first ten kilometres of the Crust; whilst the geodesist, is specially interested in the broader effects mainly due to deeper or more wide-spread structures. For the geodesist therefore, the spacing of gravimeter stations need not be closer than ten kilometres. This reduces the problem considerably; only a small fraction of the total number of gravimeter stations need be considered for record purposes. This is important because the mass of data must

be reduced to manageable proportions, both for purposes of actual recording and for subsequent use.

It also means that the agencies engaged in mineral exploitation need not be asked to disclose the smaller details, which for various good reasons they would prefer not to publish. With this proviso, these agencies will, I am sure, be most willing to co-operate. That, at least, has been my own personal experience.

The method of selecting the data is important. It should be an unbiassed, random, evenly spaced selection. It should not be based on a consideration of the actual gravity values themselves : that is, it is not desirable specially to select for record gravity *highs* or *lows* etc. Nor is it desirable to select on topographical considerations : that is, data from the tops of hills or the lowest parts of valleys etc.

A purely geometrical selection is suggested; that is, to select for record those stations, which fall nearest to the corners of ten kilometre squares drawn over the area. This will be very convenient in all those countries which have adopted a kilometre grid for their topographical maps.

The next problem is what should actually be recorded :

First for each area of gravimetric work, a record is necessary of the base station or stations on which the absolute values of gravity are based, the adopted values at these stations and how derived. If these are pendulum stations, corrections based on the gravimetric work itself may have been applied to the normally accepted values, and this should be stated.

Secondly the essential data for each station are those in the first five columns of the admirable *Catalogue of the Isostatically reduced Gravity Stations,* published under the direction of Professor HEISKANEN at the Isostatic Institute.

These columns are :

1. Number and name of station
2. Latitude
3. Longitude
4. Elevation
5. Observed gravity.

These five columns contain the vital information, and should be recorded and published without waiting for special reductions to produce Bouguer or Isostatic anomalies.

Frequently the Bouguer anomalies have already been found, (and sometimes and better still, the isostatic anomalies). If this is so, these anomalies should be copied out for each station, and also the theoretical value of gravity, γ_0, and the Free Air Anomaly, if these too can be copied directly from the files. Usually too there will be a small

scale chart of iso-anomaly contours got out for determining the regional effects, a publication of this would be most useful, but is in no way a substitute for the five columns of essential data.

In all cases where anomalies are recorded, the method of reduction must be clearly stated, together with the gravity formula adopted and the density values used. This is specially necessary in the case of Bouguer anomalies, of which there are many modifications. Summing up, it is very desirable, as soon as possible after a gravimeter survey has been completed, to publish a list of stations giving latitude, longitude, height and the observed gravity, and details of the base station or stations used.

The stations should be selected on a closely geometrical spacing of ten kilometres, if the area is small. Publication of these data should not be delayed to get out anomalies or charts. Though these should also be published if readily available.