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Short Communications

Technique for Simultaneous Observation of Gravity and Vertical Gradient Data

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The first vertical gravity gradient observations in the field using Δh intervals of 112 to 150 cm were carried out in 1943 (Thyssen-Bornemisza, 1944) and about ten years later a vertical gradient profile was taken in Canada over known geological subsurface structures (Thyssen-Bornemisza and Stackler, 1956). More recently close to one thousand vertical gradients were observed in Texas and New Mexico by Hunt Oil and a brief analysis of some results were presented (Thyssen-Bornemisza and Jacobi, 1971; Thyssen-Bornemisza et al., 1972). Further experimental surveys were taken in Germany and the Alps (Janle et al., 1971) and general assessments are published by Haase (1968), Hammer (1970), Hammer and Anzoleaga (1975), Thyssen-Bornemisza (1957, 1972, 1974) and Trommer (1964).

Purpose of this brief report is to propose a simple technique for simultaneously observing vertical gradients in addition to relative gravity data with the same equipment. Let us consider the equipments used by Janle et al. (1971) or, by Hunt Oil (Thyssen-Bornemisza, 1972), then the lower stage of the up-and-down technique uses a conventional tripod on which the gravity meter is placed. However, the same gravity meter also could be used to observe gravity differences between stations if the instrument is calibrated by a reference point. The upmeasurements to get the vertical gradients then could be carried out in the usual manner. Of course, standard correction of elevation and terrain must be considered to obtain acceptable free-air gravity values, but this could be of value also for the correction of vertical gravity differences. Accordingly, the same equipment would provide gravity and vertical gradient information with only little cost and time. A practical application could be seen in the immediate correction of gravity surveys by vertical gradients presented a few years ago (Thyssen-Bornemisza et al., 1972).

This author believes that experimental evidence to prove the proposed improved technique is not necessary when the standard method in using the up-and-

down technique is employed. Of course, vertical gravity gradiometers (Groten, 1975) could not be used for the suggested simultaneous approach.

Finally, the simultaneously observed gravity and vertical gradient profile is now briefly discussed. As mentioned before, a suitable reference point must be used for calibrating the "down" situation of the gravity meter used for the up-and-down technique. After observing 5 or more profile points a return to the reference point seems to be adequate. Furtheron, for computing the vertical gradient data running averages should be used according to formula

$$\overline{\Delta g/\Delta h} \cong (1/N) \sum_{i=1}^{N} (\Delta g/\Delta h)\, i$$

where N denotes the number of profile stations. This method should reduce possible errors caused by irregular surface density including varying soil humidity (Haase, 1968; Thyssen-Bornemisza and Jacoby, 1971). In general relatively flat terrain and station spacing less than 50 m seems preferable, but with proper corrections vertical gradient measurements are less restricted (Janle et al., 1971).

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