LIGHTNING STROKES AND MAGNETIC SURVEYS

During a field magnetic survey of the Canobolas Mountains volcanic complex near Orange, Central Western New South Wales (Facer, 1968), the sites of several lightning strokes were detected. These showed up as very strong, localized anomalies, and were complemented by evidence additional to the field magnetic observations. Four examples will be commented on here, being discussed in the order in which they were "discovered". Readings were taken using a McPhar M500A fluxgate magnetometer.

One site was on the top of the Old Man Canobolas, which at 1400 metres above sea level is the highest point in the Orange district. Outcrop on this peak consists of trachyte, and andesitic agglomerate, and although the latter rock type would perhaps contain large blocks which were highly magnetic, there were no obvious blocks at the centre of the anomaly. The anomaly had a magnitude of about 4000γ, spread over a rather small area of about 30 metres by 15 metres (being checked by readings taken perpendicular to the traverse). Elongation was East-West, although the effect was very localized.

A second site was a more pronounced anomaly on the Southeast slopes of the Canobolas Mountains, but well-removed from the higher peaks. The "surface geology" consisted largely of clayey soil. Here the reading range was more than 9000γ(over a restricted distance of 7 metres, a road-cut and fencing preventing the taking of readings over the surrounding area), and was centred approximately at a tree strump which appeared to have been struck by lightning. Similarly, in the undulating Southeastern foothills of the Canobolas Mountains, at an outcrop of augite trachyte exposed in a graded road, a strong anomaly was recorded. At this point it was possible to sample the rock at the centre of the anomaly, and thus the magnetic properties of the rock could be studied. The rock contained about 2 per cent magnetite and titano-magnetite, and was appreciably weathered. However, a large portion of the high NRM intensity (near 900 x 10^{-4} emu/cm^3) was very quickly removed both by partial AF and by thermal demagnetization, and thus the CRM component was probably small. This would suggest a remagnetization by lightning.

Columnar basalt outcrops in the low hills on the Southern outskirts of Orange. A few of these columns, at different sites, gave very strong anomalies when magnetometer readings were taken above the vertical columns. For example, in an area of outcrop of the tops of a few columns (which were about 2/3 metre in diameter), the readings varied from -5,000γ to +25,000γ when standing and taking the readings a metre above the surface (the reading when the magnetometer was placed on the rock was +72,000γ). This variation might have been due to a lightning discharge, but there was no evidence in the pattern of readings for this. If not due to lightning, then a possible relationship exists between columnar development of basalt and magnetic intensity. However, these anomalous results were not widespread on the columnar basalt, nor were the magnetic properties of samples of these basalts helpful in reaching a conclusion. Other studies (Cox, 1961; Graham, 1961) have shown that currents set up by lightning cause localized and highly variable changes in direction and intensity of magnetization within, for example, basalt - but the Orange observations are perhaps still not adequately explained.

In addition to the obvious academic considerations of sampling of rocks (for palaeomagnetic and rock magnetic studies), the sites of lightning strokes should be avoided in magnetic surveys. Obviously the importance of a single anomalous reading depends on the scale of the survey, the station spacing and subsequent analysis of the data. An anomaly of several thousand gammas would in most cases distort the results of a traverse - especially if the prospective target of the survey is a narrow planar body. To avoid such problems in this survey of the Canobolas Mountains, and since station spacing was never less than 100 metres, four readings were taken at each station at each corner of a metre square. This simple precaution enabled avoidance of very small intense anomalies since discrepancies between these four readings could be readily checked.

ACKNOWLEDGEMENTS

The work was undertaken in the Department of Geology and Geophysics at the University of Sydney and the assistance of Professor C.E. Marshall and Dr. A.A. Day is gratefully acknowledged. Dr. A.A. Day, R.J. Henderson and E.P. Shelley assisted with helpful discussions. I am grateful to the District Forester at Bathurst, and Mr. G. Windsor, Forester, N.S.W. State Forestry Commission, for access to the Canobolas Forests, and to the management of Orange Blue Metal Quarry for permission to sample. Dr. E.R. Phillips kindly read the manuscript.

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