

# SIGN CONVENTIONS IN MAGNETOMETRY FOR SOUTHERN HEMISPHERE

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## Discussion

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I would like to add to the discussions on sign conventions in magnetometry for the southern hemisphere which were published in the last issue of the ASEG bulletin.

The main points which I believe have emerged from the discussions are listed below -

(i) The use of a reversed convention (magnetic inclination positive upwards) is well entrenched in Australia.

(ii) A change to the normal convention (magnetic inclination positive downwards) would involve some re-education of personnel.

(iii) There is a trend toward the manufacture of lightweight, one-man operated total field magnetometers.

The reversed convention with vertical field instruments is more compatible with total field results over the greater part of Australia. It can be confidently predicted that total field instruments will come into more common use and may eventually replace vertical field instruments entirely. Hence it is an inappropriate

time to consider changing a well entrenched practice.

Notwithstanding the above remarks, it is certain that vertical field instruments will still be in use for some years. I remain of the opinion that standardisation of practice is desirable. To minimise disruption, I think that the ASEG should advise members to adopt the reverse convention as the standard for field practice.

I agree with Emerson, McSharry and Smith that the N.O.A.A. convention should be used for formal presentation of data.

Dr. R. Green (University of New England)

All geophysicists should be aware that the lines of magnetic flux come up out of the ground in the Southern Hemisphere and head northwards, whereas in the Northern Hemisphere the lines of flux dive into the ground and head southwards. In the generally accepted system of co-ordinates, the positive direction is taken as downwards. This causes no difficulties for surveys carried out in the Northern Hemisphere but it causes difficulties in the Southern Hemisphere,

because we like to think that a "positive" anomaly is to be found to the equatorial side of an induced pole whereas in reality, it is not positive but more negative. The problem is best overcome by quoting the absolute value of the field at a base station (e.g. -52000 gamma), and for the contours on the magnetic anomaly map plotting the magnitude of the absolute values of the magnetic field. This avoids the apparent difficulty of a negative anomaly occurring to the equatorial side of a body of high susceptibility. While such a procedure is simple, to avoid continuing the confusion, it is necessary that when this procedure is adopted, it must be clearly stated on the contour map.

However, the above advice is of little help to a field operator who wishes to know which way round his magnetometer is wired. The best advice I can offer is that the field is always more negative when just on the equatorial side of a piece of railway line placed on the ground in an E-W direction than when further away. After carrying out this simple experiment, the sign for the fieldman to use is obvious and surely we can expect contour maps in future to show the magnitude of the absolute value of the magnetic field with the true absolute value of the base station quoted as well as being indicated on the map.

J. Daly (Broken Hill Pty. Ltd.)

I agree in general with the view of Mr. Chamberlain. For data such as observatory data, which is of global significance, a uniform global convention is obviously necessary. However, ordinary prospecting data is only of wide significance insofar as it can be related to rock type. On a world wide scale, the most suitable convention is that which ensures that rocks of the same type are generally associated with anomalies of the same type. The convention at present in use achieves this as far as is possible. Also a similar convention is effectively used in published aeromagnetic data, and the possibility of direct comparison of ground and aeromagnetic data is an important factor. Admittedly, it is theoretically possible that difficulties may arise in low magnetic latitudes. However, experience in such latitudes suggests that in practice, other difficulties are likely to be encountered, in comparison with which this one is of minor importance.

The question of published interpretative material appears hardly relevant. Such material can only be used safely by experienced geophysicists, particularly as applied to ground surveys. The only real cause of serious trouble arises from the use of an instrument which reads in the opposite sense to that required by the convention. This can be overcome by proper recording of the instrumentation used in a particular survey. It

may be admitted that not enough attention is paid to this matter, and a strong recommendation in this regard would be useful.

#### SUMMARY AND RECOMMENDATIONS

J. Langron - President A.S.E.G.

From the forgoing discussion it is clear that strong arguments can be put forward to counter either recommendation regarding the sign convention for vertical component magnetic data in the Southern Hemisphere.

It is of little use claiming that geologists are not able to appreciate magnetic data presented in the global sense when all that is needed in many instances is a simple rotation of the plotted data. At the other extreme there are situations where interpretation is complex and a skilled geophysicist is essential. In any instance it is desirable to have a qualified geophysicist interpret magnetic data so that any subtleties in the data are appreciated.

We are an exploration (i.e. a practical) profession and intuitively both geologists and geophysicists associate normally magnetized rocks with positive anomalies. In addition, as one writer points out, exploration geophysicists have an obligation to communicate their findings in the clearest terms to other exploration personnel.

There can be no argument concerning the presentation of magnetic data of global significance; these data must be

presented in the global (N.O.A.A.) convention.

On the exploration side, the topic under review is not considered to present serious problems and as more and more magnetic surveying is being carried out with total force instruments the problem of sign convention will tend to diminish.

Taking into account all the points raised in the discussion, the A.S.E.G. makes the following recommendations in respect of exploration data, and hope industry in particular will agree to conform.

1. That magnetic data in the Southern Hemisphere be presented in reversed convention, i.e. that the inclination of the earth's magnetic field is assumed positive upwards.

2. It is essential that all magnetic maps contain a clear statement of the sign convention used.

3. It is desirable that maps indicate, where possible, the absolute value of the base station used for the presentation of data.

Apart from the topic per se, the comments present a considerable gleaning of ideas relevant to the fundamentals of magnetic measurement and the Committee feels that many members will appreciate such a spectrum of comments from highly qualified geophysicists. We wish to thank all contributors and especially Mr. Shalley for initiating the discussion.