



Are all reversals symmetric? The search for latent components of magnetisation in late Precambrian (Torridonian) sediments of Northwest Scotland.

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The symmetry of the dynamo equations, and the experience and assumption of the palaeomagnetic community, is that when averaged over time, normal and reversed palaeomagnetic pole directions should be antiparallel. Nevertheless, a number of studies over many years have produced results where the poles are not so positioned. For many workers, this failure of the reversal test results in the automatic rejection of the data. However, some recent numerical simulations have produced results where the symmetry of the normal to reversed state is broken. This physically counterintuitive result probably because of insufficient computational averaging time, but this only raises the question as to how long a palaeomagnetic record is necessary for symmetry to be established - does the dynamo retain a memory of its previous state after reversal?

Several palaeomagnetic studies have presented and refined a magneto-stratigraphic framework for the Torridon Group which forms part of the late Precambrian Torridonian Supergroup of Northwest Scotland. The zones of alternating polarity do not record a series of anti-parallel reversals. The two directions lie at or about 140° apart. This pattern of magnetisation was identified in the earliest palaeomagnetic studies of these rocks and it has been, in general, confirmed by later work. In the absence of reliable demagnetisation equipment the early workers, quite reasonably, suggested that the lack of anti-parallel directions may be due to the presence of an additional component of magnetisation and this explanation has been adopted in several later studies.

Demagnetisation of these "Torridonian" directions has revealed behaviours that may be interpreted as single component magnetisations (directions that are stationary whilst the intensity of the remanence decreases). Thus, if an additional component is present it is to some degree hidden or latent.

Using the results of previous studies and an understanding of demagnetisation procedures sampling strategies and analytical programmes have been designed and implemented with the aim of isolating any latent components should they be present.

The results can be interpreted in one of two ways: (1) an additional component is present but it has peculiar almost absurd characteristics or (2) no additional component is present and the palaeomagnetic data from the Torridon Group can be interpreted as a record of non-antiparallel reversals of the Earth's field during the late Precambrian. We favour the second conclusion.