Using an old brass theodolite for a declination and inclination magnetometer - how good is it?

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A b s t r a c t: New Zealand runs two observatories, Eyrewell (on the east coast of South Island) and Scott Base in Antarctica. A lack of funds for purchasing new equipment and dissatisfaction with commercial instruments that we had seen, lead to the development of our own instruments for these observatories, for both digital recordings and absolute observations. Both types of instruments are based on the same parallel core fluxgate sensors, which were built locally.

The most expensive part of all the equipment was the non-magnetic theodolite used as the basis of the Declination and Inclination magnetometer. Old fashioned theodolites were traditionally made of brass and a second-hand one was obtained and converted into a magnetometer to evaluate its potential for use as an observatory instrument.

A number of problems were found with the instrument. Although a test had been made to check that the instrument was non-magnetic before it was purchased, offsets were discovered when it was converted into a magnetometer. The major offset was traced to four brass screws being slightly magnetic. When these were replaced, a small but significant offset remained which only showed up after analysis of a series of observations. Two small pieces of spring steel were found supporting the two vernier scales used with the horizontal circle which it is suspected are the cause of the remaining offset.

The scales are much more difficult to read than those on a modern theodolite and the vernier graduations are at 30" intervals though with care readings can be interpolated to 15". Also there is no pendulum on the vertical circle so that it must be levelled using a level bubble for each reading. These last two factors mean that the time taken to complete an observation is longer than with a modern instrument and more training would be required to get an observer to a competent level. In spite of the drawbacks the instrument is usable and, providing a theodolite can be obtained which is truly non-magnetic, any offset will be small. The observations, while having a larger standard deviation than those made with newer instruments, are still of a useful quality. The total cost of the instrument, (ignoring labour costs) was under $US1000 which may well make an instrument upgrade possible at an observatory that cannot afford a commercial instrument.

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