The Thatched Cottage
Clement Place
Cambridge.

Dec. 6.

Dear Fisher,

The data you want, so far as they exist, are in my paper "The Figures of the Earth and Moon", partly based on what I described as the world's worst-designed experiment. My formula based on the Potsdam staddard is

$$978{\cdot}049(1 + 0{\cdot}0052895 \sin^2\phi - 0{\cdot}0000059 \sin^2 2\phi)$$

The International formula is

$$978{\cdot}049(1 + 0{\cdot}0052884 \sin^2\phi - 0{\cdot}0000059 \sin^2 2\phi)$$

The absolute determinations at Teddington and Washington suggest a uniform reduction of about $0{\cdot}017 \pm 0{\cdot}002$. I should be inclined myself to give, in a very condensed statement such as you have room for, just the Potsdam values with "Potsdam standard" in brackets. The trouble is that these long-distance comparisons made by carrying pendulums about are tricky on account of changes in the pendulums on the way, and are doubtful until the pendulums have been swung again on the original place to make sure that they have behaved themselves. For instance, in spite of about half a dozen comparisons of Europe with India the results are still uncertain by about 20 mgal. What the Bullard and Browne work does is to show that the absolute values at Washington and Teddington are consistent within their apparent uncertainties, about 3 mgal. But Teddington is not well connected with Cambridge and Greenwich, which are (and therefore with almost all the world) the British stations best connected with Potsdam, and a direct comparison of T. with P. is needed to stiffen things up. Until this is done it is hardly worth while to make any change in the formula, which is really

a conventional standard of comparison and does not claim to be universally true. The important thing is to have a consistent standard of reference, and it would be a nuisance to have several competing ones. As a matter of fact an Austrian called Ackerl unearthed an absolute determination at Vienna and published about 5000 values converted from Potsdam to this standard (which deviates the wrong way !) but nobody else has followed him, and using mixtures is a plague. I should deprecate piecemeal changes.

The point of the term in $\sin^2 2\phi$ is that a consistent theory of the field must contain second order terms in at least two of the three expressions for gravity, the radius vector to the level surface, and the P_4 term in the external field. These can't yet be fixed from observation, but it is important in standards of comparison that they should be consistent : this was done so that the level surface is an exact ellipsoid.

I don't think you can possibly give more than the conventional values - the actual variation with height differs from place to place and there are other significant harmonics which can't yet be properly sorted out. Washington itself has rather a big anomaly; but the m.s. departure from any elliptic formula is about 22 mgal.

I see you give Boys's value 6·658... for the constant of gravitation. On this see p.245 of my book. I should recommend $(6{\cdot}670 \pm 0{\cdot}0037)10^{-8}$, but this is virtually on only three d.f. I hope you will attribute the geological time scale to Holmes and not Barnes!

I wonder occasionally whether your way of treating rank correlation could be adapted to one variable so as to give estimates of approximately uniform efficiency independent of the form of the law of error. E.g. the median observation has roughly uniform efficiency over the range of Type VII laws, and there may be something more general. In the case you treat

your method must be the best if the data are really drawn from a normal correlation surface, and it is possible to say what your r is an estimate of ; but it would be interesting to know how far it retains its meaning when the joint law is different. One point about it is that its r is an estimate of the same thing whatever the number of observations may be ; I am not at all clear that the Spearman coefficient is an estimate of anything definable irrespective of the number of observations.

Yours sincerely,

Harold Jeffreys.

Ages: from Holmes "The Age of the Earth" 1937, p178

Drift

	m.y.
~~Tertiary~~ Tertiary + Quaternary	70
Secondary (Mesozoic)	110
Permian to Carbonic	140
~~Dev.~~ Silurian to Cambrian	>160

The greatest age for mineral is about 1800 m.y. It would strain the data to make the age of the earth more than about 2500 m.y.