news and views

The end of the expanding Earth hypothesis?

from Peter J. Smith

On the face of it, this is a bad day for the handful of people who support the idea of an expanding Earth, a good day for the few who oppose it, and certainly no less than an interesting day for the vast majority of Earth scientists who have been content merely to observe the progress of the expansion debate for anything up to 20 years. For on page 316 of this issue of *Nature*, McElhinny *et al.* offer the most convincing proof yet that, despite some obvious attractions, Earth expansion is nothing more nor less than a scientific blind alley. Specifically, they use the best available palaeomagnetic data to show that over the past 400 Myr the Earth's radius cannot have increased by more than 0.8%, a figure sufficiently small to exclude the very low rate of expansion (0.6 mm yr^{-1}) proposed by Wesson (*Q. Jl R. Astr. Soc.* **14,** 9; 1973) as well as the much higher rates favoured by, among others, Carey (in *Continental Drift—A Symposium,* University of Tasmania, 1958).

So that is the end of the Earth expansion hypothesis. Or is it? Before passing the death sentence it is perhaps worth making two points which may be interpreted as reasonable caution or unreasonable scepticism, depending upon one's point of view. First, history has shown that where the Earth sciences are concerned it is often dangerous to express absolute certainty. The continental drift saga alone is sufficient indication that even the most solid of foundations may crumble, especially if they are given a kick by a passing stranger. In the case of continental drift the stranger was a meteorologist, but for Earth expansion it could well be the first physicist or astronomer to delineate the historical variations, if any, in the gravitational constant. Earth scientists have been conscious of the possibility of Earth expansion ever since Dirac (*Proc. R. Soc.* **A165,** 199; 1938) suggested that the gravitational constant may be slowly decreasing; but although convincing proof of such a decrease has never yet been produced there is still an outside chance that it will be. In that case, of course, expansion of the Earth would have to be accepted; and however hard it may be for them, Earth scientists would have no option but to re-examine their supposedly foolproof analyses.

But if that is a possible problem for the future, there is also the more immediate question of the validity of palaeomagnetic techniques for determining the Earth's palaeoradii. As McElhinny and his colleagues point out, Egyed (*Geofis. Pura Appl.* **45,** 115; 1960) was the inspiration for the use of palaeomagnetic data as a test for Earth expansion. His first proposal was limited to palaeomagnetic sampling sites on the same palaeomagnetic meridian, but he later (*Nature* **190,** 1097; 1961) suggested a less restrictive technique applicable to palaeomagnetic data generally. In the much improved version developed by Ward (*Geophys. J.* **8,** 217; 1963; **10,** 445; 1966) this 'minimum scatter method' involves the determination, for a single landmass, of palaeomagnetic pole positions for a series of assumed palaeoradius values. The 'correct' palaeoradius is then taken as the one corresponding to the minimum scatter of poles. Unfortunately, in the hands of Ward and others the method achieved only limited success, for at that time palaeomagnetic data were neither accurate nor extensive enough to enable any but the greatest of suggested palaeoradius changes to be detected.

That position has now changed, however, and McElhinny and his coworkers have been able to revive Ward's method in conjunction with palaeomagnetic data capable of resolving the smallest changes in the Earth's radius ever proposed. But irrespective of the quality of the raw data, is Ward's method valid in the first place? McElhinny *et al.* evidently believe that it is; but Carey (*The Expanding Earth,* Elsevier, 1976) has already argued at great length that it is not. He concludes that the minimum scatter of poles will always occur when the assumed palaeoradius of the Earth is about equal to the present radius; so however good the basic data and however much the Earth's radius has really changed, the application of Ward's method will inevitably lead to the conclusion that the Earth has not expanded at all.

Ward assumes that although the shape of the continents must change slightly as the curvature of the Earth's surface changes, they remain constant in size and the distances and angles used in interpreting the palaeomagnetic data in terms of the palaeoradius also remain constant, when measured from a 'central point'. Ward took as the 'central point' the mean position of the rock units studied; Van Hilten (*Tectonophysics* **5,** 191; 1967) later took the centroid of the continent; McElhinny *et al.* (who refer to the "continent keeping the same physical dimension") use both the average site location and the "approximate centre of the continental block", discovering in the process that both lead to very similar values of palaeoradius.

Carey contends, however, in a long and involved geometrical argument that during expansion of the Earth a continent will deform in such a way and to such an extent as to make nonsense of any simplified model used in the determination of palaeoradius from palaeomagnetic data. If he is completely right, palaeomagnetism presumably has no role in detecting any possible increase in the terrestrial radius. If he is right in principle but not practice (perhaps because the continental deformation is too small to invalidate Ward's model), palaeomagnetic methods will be acceptable as long as the basic data are good enough. If he is wrong, there is nothing to worry about. The fact is, however, that whether Carey is right or wrong his criticism exists and has apparently never yet been refuted explicitly. Until someone chooses to do so, there must be lingering doubt in the minds of disinterested observers. □

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