Comments and Communications

Discordant Time Scales

The superposition of one time scale on another may produce weird results. Dating the birth of the moon and the attendant and consequent terrestrial pangs in the Mesozoic era will make most geologists sit up and take notice. On the other hand, the dating as Miocene, or earlier, of the upheaval of mountains which have since lost little or none of their altitude under the attack of erosional processes sometimes passes unnoticed, though it also must be regarded as of doubtful authenticity if one is willing to adopt the modern scale, which pushes Miocene events back twenty to thirty million years.

For examples of such confusing time scales it will suffice to refer to two publications recently issued in Vienna by no less authorities than F. X. Schaffer, author of a classic three-volume textbook of geology, and the distinguished geographer, Johann Sölch.

Schaffer (*Der Mond und das Leben*, Vienna: F. Deuticke, 1948) advocates the Kant-Böhm-Schaffer theory that very considerable changes in the shape of the earth have taken place, even in late geological times, as a result of the slowing down of the earth's rotation due to tidal friction. He claims that these changes have been great enough to cause the catastrophic and more or less rhythmic tectogenies that have deformed the crust and also the periodic interchange of land and sea, as well as changes of altitude and of continental configuration capable of profoundly affecting geological climates.

Against such a theory are usually set the fact that earth tides are now minute and the dictum of astronomers that the rate of rotation of the earth is not now changing appreciably. Accepting the suggestion that the present rate of change in the length of the day is of the order of 1/200 sec per century (Poynting, J. H. *The earth.* Cambridge: Univ. Press, 1913) and without pretending to have a reliable basis for calculation, one might think of the resulting change in the oblateness of the earth as reducing the excess of the equatorial over the polar diameter by a few hundred feet at the most, in 50 to 100 million years. However wild this estimate may be, it is obvious that the change is not likely to be sufficiently great to produce spectacular results, and it is not surprising, therefore, that Schaffer has stood alone in his support (*Lehrbuch der Geologie, I.* Vienna: F. Deuticke, 1922; *Pan-American Geologist*, 1928, **50**, 121) of Böhm-Böhmersheim (*Abplattung und Gebirgsbildung.* Vienna: F. Deuticke, 1910).

The days of active tidal evolution are certainly much more remote than any one thought possible when, 70 years ago, G. Darwin formulated the theory of the lengthening of the day, with all its necessary consequences of change in the shape of the earth globe. Instead of between 50 and 60 million years, which was Darwin's estimate of the time that has elapsed since, as he supposed, the moon parted company with the earth, R. W. van Bemmelen (*Geologie en Mijnbouw*, 1949, **11**, 1–21) now allows nearly two thousand million years; and to this evaluation may be added at least a thousand million years more if A. Holmes' estimate (*Nature*, Lond., 1947, **159**, 127) of the age of the earth is acceptable.

Notwithstanding the obvious necessity of moving with the times to the extent of expanding Darwin's time scale in a consistent manner, Schaffer retains it without modification. In his latest work (*Der Mond und das Leben*, Vienna: F. Deuticke, 1948) this scale is superposed on an absolute timing of geological chronology which, though not quite in accordance with the most recent age determinations, is at least very much slower than any that was popularly approved when Darwin made his calculations, and the astonishing conclusion emerges that somewhere between late Carboniferous and Jurassic times (the 56 million years ago of Darwin) the earth rotated once every 6¾ hr. The author then resorts to extrapolation and by this means estimates that some time in the Algonkian (when a certain ameba took its 34-min pulsation period from the tidal interval on the birthday of the species) the earth was rotating once every hour. If it were possible to accept such evidence of spectacular slowing down of the earth's rotation in geological times, however caused, the Kant-Böhm-Schaffer theory would receive much support.

The story of the eastern Alps as unfolded by Sölch begins with moderate uplift of a very well-developed peneplain, which suffered some dissection and was then further warped up to its present summit altitude. So the tectonic form of the mountains has come to consist of northern and southern upheaved arches, between which is the Noric furrow, a broad strip of relatively depressed country carrying consequent east-west drainage. Though the warping is assigned the date of the assumed contemporaneous depression of the Vienna basin, which was flooded by a middle Miocene sea, dissection, while further advanced on weaker parts of the terrain, has failed as yet to break the continuity of the peneplain over much of the higher northern arch, for this is formed of a thick mass of resistant limestone.

Thus all the landscape evolution described might be pictured as spread over two or three million years, scarcely longer. Miocene events are now relegated to a past ten times more distant than this, however, and this perhaps warrants a suggestion that the peneplain here involved intersects and is of much later development than the land surface buried under the sediments of the Vienna basin. If it is not so, and if some 25 million years has been occupied by this mild warping upheaval and the development in a new cycle of mature erosional relief over only the weaker parts of the area affected, how much—how very much—longer a period will have to be allowed for the development of the earlier peneplain, which truncates varied structures as well as an enormous potential

relief, and for the Alpine folding in which that earlier complex structure and relief had their origin?

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A Suggested Method for Estimating Pre-Hunting Season Status of Scaled Quail Populations

It is desirable in game management to have practical, quantitative "yardsticks" which can be applied to game populations in order to aid the administrator in formulating well-advised harvesting regulations.

The following suggestion relative to estimating the population status of scaled quail (*Callipepla squamata pallida*) may have value, though admittedly there are no known instances in which it has been tried on an extensive scale. The type of range favored and the coveying habits of the species render it relatively easy for experienced field personnel to net scaled quail alive in numbers after the fall covey-gather. The grown young-of-the-year can easily be distinguished with great certainty from all other age classes by minor, but apparently constant, differences in the plumage. Hence, the age ratio thus established indicates the degree of success of brood survival in that year up to the time the observations were made. Brood survival, indicated by the ratio between young-of-the-year and adults, presumably is a reliable index of the state of vigor of the population as a whole, and should therefore also be a good index of the actual abundance of the species when large areas are considered, except in grossly underpopulated range. It is now well established that in quail, as in other upland game birds, it is the bird-of-the-year that provides most of the shooting (Steen, M. O. *Trans. 9th N. A. Wildlife Conf.*, 1944, 331).

For the six to eight weeks prior to date of setting the quail hunting regulations—say, from about the middle of September to the middle of November—a great deal of pertinent information could be secured by one or more two-man crews, each provided with two jeeps equipped with small hauling trailers, if these crews are assigned to net and examine as many quail as possible in as many key areas as possible of the administrative unit concerned. It should then be possible to ascertain the actual age ratio among a sizable sample of the quail population. The netted quail, of course, could be released unharmed at the trapping site as soon as they had been processed.

The technique of netting quail by means of the modified fyke net with long, V-shaped wings of cord netting is probably too well known among game men to merit detailing here. Suffice it to say that whole coveys may often be maneuvered into such nets by two or three experienced men, on foot, on horseback, or with the aid of vehicles. Trapping the birds in fairly large numbers is unquestionably, a practical matter. J. S. Ligon (in a paper published by the New Mexico Game and Fish Commission, Santa Fe, 1946) gives particularly complete directions as to this procedure.

A. C. Bent (*Bull. U. S. nat. Mus.*, 1932, 162, 54) states that scaled quail undergo a complete molt in August and September, at which time the young-of-the-year become practically indistinguishable from the full adults except for the retention of the first two juvenile primaries in each wing. The writer has found this criterion difficult to apply, but fortunately there is another easier and possibly more accurate method (Leopold, A. S. *J. wildlife Management*, 1939, 3[3], 261; and FIGGE, H. *Proc. 26th ann. conf. west. ass. state game fish commissioners*, 1946, 161). This method depends on the retention of the juvenile primary covert feathers until the bird is well into its second summer (age 15–18 months). These juvenile primary coverts are conspicuously mottled with a whitish or buffy color. In the fully mature adult condition, assumed after the first postnuptial molt, they are plain bluish gray. This method of distinguishing age classes is considered to be extremely accurate, and has been used personally by the writer in quail investigations in New Mexico with very satisfactory results. Incidentally, it appears to work as well for Gambel's quail (*Lophortyx gambeli*) and Texas bob-whites (*Colinus virginianus texanus*) as for scaled quail. The method is used as standard procedure for aging quail at the New Mexico State Game Farm (personal communication from Superintendent James L. Cox). Furthermore, Ligon, an outstanding authority on upland game, has also used this method extensively in aging quail and considers it to be extremely reliable (personal communication).

The age ratio is easily secured from the raw data. For example, a ratio of 1000 young to 1000 adults would give an age ratio of one young to each adult, or two young to each pair, assuming a 1:1 sex ratio and all birds breeding. Such an age ratio over a large area in the fall before the hunting season would indicate poor brood survival, and presumably a general unthrifty condition of the quail population. A restricted season and bag limit would apparently be indicated for that year. On the other hand, suppose the raw data to be 1500 young to 500 adults. The resulting age ratio would be three young to each adult, or six surviving young to each pair. This would indicate rather good brood survival, and presumably a thrifty condition of the quail population. A longer season and a more liberal bag limit could accordingly be endured by the quail without unduly cutting into next year's breeding stock.

Besides securing age class data, this suggested procedure could also be made to yield extremely valuable basic data as to prevailing sex ratios and, by making banding of each bird trapped a routine part of the procedure, could aid in gradually building up very useful statistics relative to survival and movements of the banded birds.

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