DISCUSSION

MIMA MOUNDS

CHAPMAN GRANT
San Diego, California

Dr. Victor B. Scheffer published an interesting article (1947) on the origin of the "mounds" which are to be found throughout much of the western plains. The title, *The Mystery of the Mima Mounds*, leaves us to guess whether or not he solved the riddle. In his text Dr. Scheffer is satisfied that they were built by pocket gophers. In an earlier article, which he wrote with W. W. Dalquest (1942), the case is more convincingly stated. His arguments may be paraphrased somewhat like this:

In deep soil the pocket gopher digs his tunnels, lines his underground nest, and lives his life without causing any changes in the landscape. If, however, there is a hard substratum within a foot or two of the surface, his actions are entirely different. A nest site is then dug deep into the hard stratum. This done, the gopher digs radiating tunnels for foraging. He brings a minute excess of soil *toward* the nest site over what he takes *from* it. After thousands of years his descendants have accumulated a "mound" at the original nest site. His progeny has peopled the entire shallow-soiled prairie as thickly as the forage will permit, and this proximity governs the spacing of the mounds as they are now found. Cobbles which occur in the hill are gradually settled by his digging under them to construct a deep nest for his young—safe from wandering bear, wolf, and wildcat! In excavating his foraging tunnels between mounds, he is motivated by a less vital instinct, so, having no reason to go deep to protect his young, he merely passes around any cobble encountered, and, because the soil is gradually moved to the hill, cobbles are exposed and strew the intermound spaces. All mounds are gopher-made whether gophers now inhabit the area or not. Shallow groundwater may have the same effect as a hard substratum.

The following points made by Dr. Scheffer (1947) are followed by the writer's criticism.

1. At certain places [the gophers] dug deeply into the gravelly subsoil in order to make nest chambers.

Years of experience with the pocket gopher has convinced me that its nest chamber is no deeper than most of its burrow. Dr. Scheffer's figure 2 illustrates the shallowness of the nest.

2. Because of depth, the nest chambers are ". . . well protected from prowling bear, wolf or wildcat."

The chief protection of the gopher, like that of the rabbit, is its fecundity. In addition, it tries to stay underground and keep its burrow well plugged. Dr. Scheffer apparently thinks that predators seek the young in preference to adults. The number of nests destroyed by bear or wolf must be very small compared to the adults destroyed by these two animals. The number of nests dug out by wildcats is 0. A wildcat does not dig. The real vertebrate enemies of the gopher are snakes, owls, hawks, and weasels. Disease and parasites, drowning and starvation, are the effective checks on this rodent—not bears.

3. "Areal spacing of the nest chambers corresponded to the size of the 'territory' of each animal. The center of an old territory now marks, we believe, the center of a modern mound."

The territory of a pocket gopher does not normally radiate from a center but is, instead, a rather long, narrow figure, or a line. Nowhere are territories found as close together as are the mounds, or as evenly spaced. The evenness of distribution is too great in that it would require a vast pasture, rich enough to support an evenly concentrated population. In reality, any such expanse would contain areas of poor pasture, where mounds would have been spaced farther apart or would be missing.

4. "When the animal ran into a large boulder it undermined the obstruction and allowed it to settle."

This assigns a complicated purposeful action on the part of the gopher in excavating its nest

site. There is no evidence to support this statement. The use of the term "boulder" in many places in Dr. Scheffer's article is incorrect. The author means "cobblestones."

5. "Thus, we now find, at the base of most mounds, a concentration of coarser materials."

Dr. Scheffer tries to prove a point uncalled for by his own theory. His gophers are supposed to have started upon a flat plain and to have ultimately piled up mounds containing pebbles "no larger than walnuts." He now attempts to prove how the gophers got "boulders" *out* of mounds which could not have contained anything larger than a walnut in the first place!

6. According to Dr. Scheffer, when the gopher dug tunnels for foraging, it was driven by less powerful instincts than that of nestbuilding, so, when it encountered a rock, it simply passed around it. I do not believe that a gopher acts differently toward an obstruction in a runway or a nest site.

7. ". . . shoving dirt along as it went."

Apparently the object of this statement is to prove that gophers might push more dirt in one direction than in another. Actually, gophers make "spoil" dumps at more or less regular intervals along their rather straight line of burrowing. There is no evidence that the dumps are placed in any position or direction other than that dictated by convenience.

8. "Thus, we find plainly exposed in the intermound hollows large boulders that were doubtless at one time buried in the topsoil."

This would be possible only if the gophers continually made their spoil dumps toward a center. There is no reason to believe that such was the case. They certainly do not do so at this time.

9. ". . . 'mound roots' . . . are simply abandoned gopher tunnels now filled with black silt. . . . They call to mind the peculiar devil's corkscrews . . . [of] Nebraska . . . [which] are now generally believed to be the casts of burrows of extinct rodents."

In a footnote Dr. Scheffer refers to A. L. Lugn (1941, p. 673). Lugn, however, stated: ". . . vegetal origin is believed demonstrated . . . [as the cause of the corkscrews]."

10. "Where [a] nesting chamber collapsed [it] caused a depression at the crest of the mound, a characteristic feature of many of the mounds. . . ."

Dr. Scheffer illustrates everything else, even including a Fresno scraper, which is used to grade down the mounds for agricultural purposes, but omits illustrating this special depression. I have never seen such a depression and would have appreciated a picture of one. A nest chamber is the size of the bowl of a derby hat or smaller. It is never reused or enlarged, to my knowledge. Gophers do not seek out high ground for nest sites.

11. "In fancy, it is easy to picture the start of a Mima Mound."

Without proof or reason to believe that gophers move an excess of soil toward a common center, it is impossible to fancy the beginning of a mound.

12. "It is less easy to account for its [the mound's] growth."

I see no difference between the inception and the later growth of a mound. Once started, I can visualize its continued growth. Why the gophers should stop building at a certain size might be a problem; but then, muskrat nests are of approximately the same size.

13. "For reasons that may never be known, the gophers carried more dirt towards the nest than away from it."

I agree with the first part of this sentence but not the last part. In fact, I am speechless at this admission and wonder why the article was written.

Dr. Scheffer's article ends with some "conclusions" which I treat similarly to the body of the article:

14. ". . . mounds are distributed . . . exclusively in the range of the pocket gopher."

According to his own statement: "There are no gophers on the Mima Prairie."

15. "Burrowing animals with habits similar to those of the gopher, namely the ground squirrel (*Citellus*) and the mole (*Scapanus*) . . . are not pertinent to the formation of mounds. . . ."

According to his first conclusion, there are no gophers in the Mima Prairie, so they would not be pertinent either. Dr. Scheffer seems to propound a theory that the range of a species is

rather permanent. Animals as well as plants migrate with changing conditions.

I am amazed at the statement that the burrowing habits of the squirrel, mole, and pocket gopher are "similar." I cannot name three better examples of diametrically different uses of the earth by digging animals. The ground squirrel lives in colonies, burrows only for protection, and forages above ground by day. It has good eyesight, moderately developed nails for digging, and does not use its teeth for digging. The spoil is deposited at the mouth of the unplugged burrow. The mole, nearly blind, possesses a remarkably specialized body for forcing its way along under the sod in search of worms and insects. It seldom burrows, does not leave spoil dumps along its unplugged tunnel, and does not forage above ground. The pocket gopher plugs his burrow and can feed only over a radius of his body length around a forage hole—never completely emerging. (The young and males do travel above ground at certain seasons at night to start a new territory or to find a mate.) Its teeth and toenails are modified for digging and its pouches for carrying soil.

16. ". . . mounds are found only where . . .a thin layer of workable soil [overlies] a dense substratum."

Dr. Scheffer quotes Vernon Bailey as stating that mounds occur in southwestern Louisiana. There is no hard substratum there.

17. ". . . in deep sandy soil . . . [gophers] never form Mima-type mounds."

There is no proof that they produce mounds in shallow soil either. There are great areas of mounds where no gophers occur and vice versa.

18. According to Dr. Scheffer, the mounds are not deposits since they are unoriented and occasionally occur on slopes.

Dr. Scheffer's figure (1947, p. 286) shows that the mounds have a marked orientation. The fact that the mounds differ in texture from their bases proves that they were *built* by some means.

19. According to Dr. Scheffer, the mounds are not due to erosion because the interspaces are frequently closed depressions.

The most obvious disproof of dissectional residue is that the substratum differs from the mounds.

REFERENCES CITED

DALQUEST, W. W., and SCHEFFER, V. B. (1942) The origin of the Mima Mounds of western Washington: Jour. Geology, vol. 50, pp. 68–84.

LUGN, A. L. (1941) The origin of Daemonelix: Jour. Geology, vol. 49, pp. 673–696.

SCHEFFER, V. B. (1947) The mystery of the Mima Mounds: Sci. Monthly, vol. 65, pp. 283–294.

MIMA MOUNDS: A REPLY

VICTOR B. SCHEFFER

U.S. Fish and Wildlife Service, Seattle, Washington

Major Grant believes that gophers behave in one way, and we[1] believe that they behave in another—or we admit that we do not know exactly how they behave. I have plainly stated (1947, pp. 293, 294) that our evidence is indirect; that we have not seen gophers building a giant mound; that we do not know whether mound building is a contemporary or a historic process; and that we do not know whether the stimulus for mound building is a hardpan or a high water table or both.

Our main contentions are (1) that mounds of the Mima type occur only within the range of

[1] In 1942 Walter W. Dalquest and I developed the theory of origin of the Mima Mounds by gopher activity. Since Mr. Dalquest is in Mexico and unable to enter the present discussion, I am taking the liberty of defending his views as well as my own.