Mima Mounds: A Reply

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Major Grant believes that gophers behave in one way, and we believe that they behave in another—or we admit that we do not know exactly how they behave. I have plainly stated

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. (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
gophers, living or extirpated, and (2) that only a living, adaptable force, not a physical agency, could have produced the Mima-type mounds out of widely varying materials and in widely varying environments from Mexico to Puget Sound. We note that Chapman Grant does not propose an alternative theory for the origin of the mounds.

In his introduction Major Grant has par-phrased our arguments quite well. We disclaim the statement: "All mounds are gopher-made whether gophers now inhabit the area or not." There are, of course, many kinds of mounds. We claim only that the Mima-type mound or pimple mound, as illustrated in our article, is gopher-made. Furthermore, the only place on the West Coast where we have seen Mima-type mounds unassociated with living gophers is Mima Prairie, a small opening of perhaps 10 square miles. Major Grant, later in his paper, emphasizes the fact that there are no gophers here. As we have explained (1942, p. 81; 1947, p. 203), the absence of living gophers on this specific prairie is unimportant. Rather than selecting Mima Prairie as the type locality of the pimple mounds, we could as easily have selected Tenino Prairie, where there are mounds inhabited by living gophers, 1 mile southeast of Mima Prairie.

We shall attempt to answer Major Grant's criticisms, numbered for easy reference, as follows:

1. The depth of a gopher nest varies. The nests with which Major Grant is familiar may be shallow, but

   "... on the gravelly prairies of western Washington the feeding runs of [the gopher], as they approach the vicinity of the nest, descend almost vertically to depths of 2, 3, and even 5 feet... In excavating four burrow systems of this species, the writer found the nests at depths of 26, 29, 34, and 36 inches, respectively [Scheffer, 1931, p. 13]."

2. The specific enemies or adverse conditions that a gopher avoids in nest building are unimportant in our discussion. The pertinent facts are that a gopher always builds a nest, the nest is the focal point of the home territory, and the nest is deeper than the average foraging runway, Fish and Wildlife Service records of stomach examinations show, however, that gophers are eaten by bear, wolf, and wildcat; but, again, these facts are unimportant.

3. Major Grant raises an interesting question in connection with the shape and spatial relations of the foraging territory. It is true that the foraging territory, or burrow system, is more linear than circular, at any given time. Enough burrow systems have been excavated to prove this point. The burrow system is constantly changing, however, as the gopher searches for plant roots. New tunnels are made, old ones are filled; a gopher dies and another takes its place; subadult gophers leave the nest and seek new territory. We believe that the effect over many gopher generations is a honeycomb-like spacing of the mounds.

In this connection the areal distribution of other mammals is significant. On the Pribilof Islands, Alaska, the male fur seals gather in the spring, each taking up a territory on the beach and jealously guarding it from newcomers. The seals are not spaced with the regularity of checkers on a board, and yet they are certainly not spaced at random. Here we have a visible example of the fairly uniform spacing of family territories. We cannot see the spacing of gophers because they live underground, but we can infer that the individual territory tends to be circular or, more precisely, hexagonal in shape. The tightness or looseness of the network of home territories probably varies with the kind of soil and vegetative cover; that is, a gopher family requires more foraging ground where food plants are scarce than where they are plentiful.

In previous accounts we have stated our belief that the mound is developed around the center of an old nest burrow. We do not mean to imply that each mound is still the hereditary castle of a family of gophers. At any given time some mounds are occupied, and others are not. Were all the mounds occupied at once, Major Grant could reasonably feel that the gophers were overcrowded.

4. We did not state or imply that the gopher uses reasoning power. When it moves dirt from the side or top of a boulder, the boulder remains at rest. When it moves dirt from beneath the boulder, the boulder tends to settle. The evidence is a layer of coarser materials at the base of the Mima-type mound.

5. The intermound cobbles, or boulders, on the Puget Sound prairies were not moved out of mounds by gophers. They are more or less in situ, although many of them have been bared by the removal of silt gravel.

6. We feel that this is a matter of opinion.

7. Major Grant has understood us correctly. We believe that, where soil and climatic conditions are favorable to mound building, gophers do push more dirt toward the nest. In addition to mounds, of course, one can see the small spoil
heaps or gopher hills scattered on and between
the mounds.

8. It is true that gophers do not everywhere
make their spoil dumps toward the center. We
believe, though, that over periods of time, in the
shutting of dirt as the gopher digs for plant
roots and for nest and food-storage chambers,
there is a differential movement of materials
favoring the growth of the mound.

9. We inadvertently cited Lugn. We should
have cited C. Bertrand Schultz who, in 1942,
stated that "most palaeontologists now be-
lieve . . . that Daimonelices are the casts of
rodent burrows."

10. A shallow depression occurs on the top or
flank of many mounds on Mima Prairie. On
this prairie, the reader will recall, there are no
living gophers. We interpret the depression as
the collapse of an old nesting chamber some-
where in the mound. It may, however, represent
the recent activity of moles or livestock. J Har-
len Bretz (1913, p. 101) referred to "occasional
. . . sunken areas a foot or so across on these
mounds. . . . The small sunken areas are so re-
cent that the sod has not healed over the mar-
ginal cracks."

Major Grant states that "gophers do not
seek out high ground for nest sites." We have
been given two photographs taken in Texas,
showing mounds sliced open to reveal nest
chambers well above the surrounding ground
level. Here winter flooding evidently obliges
the animals to build their nests out of danger.
Penney F. English (1932, p. 127, pl. 9) has
published a photograph of a similar Texas
mound, with the statement that the gopher here
"builds its nest not deep in the ground but in an
enormous mound."

11. We find it easy to fancy the beginning of
a mound as a center of activity in the vicinity of
the nest. Others, with equal freedom, may fancy
the beginning of a mound as a platform on which
the gopher attempts to raise its nest out of the
mud at a certain season.

12. The size of a Mima-type mound in a par-
icular locality probably depends upon many
factors. We are more concerned, though, with
establishing the fact that the mounds are of
gopher origin than with the ultimate size to
which the mounds may grow. The industry of
the gopher as a mover of soils is perhaps greater
than many realize. According to Lincoln Ellison
(1946, p. 113):

In what is considered to be a representative part
of the subalpine zone of the Wasatch Plateau in
central Utah, annual displacement of soil to the surface
by pocket gophers was found in 1941 to be at least 5
tons per acre and to cover 35 per cent of the surface.
The base population of pocket gophers is estimated
to be somewhere between 4 and 16 animals per acre.

13. See No. 3.
14. See our introduction, paragraph 3.
15. We do not "propound a theory that the
range of a species is rather permanent." In fact,
we once published a paper describing the migra-
tional history of gophers (1944, pp. 308-333,
423-459).

Use of the word "similar" here is a semantic
privilege. The mole, ground squirrel, and pocket
gopher are similar in that they make tunnels and
throw out excavated soil in mounds.

16. We have clearly posed the question (1947,
p. 294): "Does ground water at certain times of
the year and in certain localities act in the same
way that a soil hardpan does. . . ?" We have
not seen the mounds of Louisiana, but, from the
evidence of aerial photographs and from cor-
respondence with Vernon Bailey, we believe
them to be of the Mima type. If they actually
are of the Mima type and if there is no hard
substrate there, the water table may act as
hardpan does on certain other mound prairies.

17. Major Grant states that "there are great
areas of mounds where no gophers occur and
vice versa." We have pointed out that the
absence of living gophers in Mima-type mounds
does not invalidate the theory of their origin in
past years by gophers. We have also pointed out
that there are many smooth prairies where
gophers are living but where conditions do not
favor the formation of mounds (1942, pp. 81,
84; 1947, p. 203).

18. Bretz's map, which we used as a figure
(1947, p. 286), perhaps suggests slight orienta-
tion. Bretz himself stated that, while there is
commonly an elongation of the mound, it "does
not conform to any definite orientation" (1913,
p. 83).

Major Grant discusses orientation, but he
does not comment on our point that the mounds
occasionally occur on slopes. Here is a phenome-
non difficult to account for, unless one accepts
the theory that the mounds are built from within,
by animals. We quite agree with his state-
ment: "The fact that mounds differ in texture
from their bases proves that they were built by
some means."

19. Major Grant's criticism is not clear.

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REFERENCES CITED


