

# THE ANT, *POGONOMYRMEX OCCIDENTALIS*, CR., ASSOCIATED WITH PLANT COMMUNITIES.

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## INTRODUCTION.

In view of the fact that *Pogonomyrmex occidentalis* exhibits a wide range of distribution in the western United States it seems advisable, in this paper, to relate it to two contrasting areas, one, Tooele Valley, Utah, the other, Craters of the Moon National Monument, Idaho. Each area represents a series of distinct vegetational zones.

## TOOELE VALLEY, UTAH.

Tooele Valley, Utah is bounded by the Stansbury Mountain Range on the west, the Oquirrh Mountains on the east, on the south by a spur of the Stansbury Range and on the north by the southern shore of Great Salt Lake. The area of the valley floor roughly totals 250 square miles.

A wide range is shown in the salinity, or the "alkali" content of the soils of the Tooele Valley. The soils of the foothills are characterized by a low salt content while those of the flats adjacent to the lake are highly saline. These salts comprise sodium chlorid and smaller quantities of the soluble salts of potassium, magnesium and calcium.<sup>1</sup>

The vegetation of the valley is markedly distributed into vegetational zones (Fig. 1) and the survey of the author, relating to the distribution of *P. occidentalis*, was entirely conducted in these various zones, beginning at the shore of the lake and extending to the foothills of the mountains.

The ant in question constructs dome-shaped mounds with surrounding circular areas cleared of vegetation, on level or gently-sloping ground.<sup>2</sup> These mounds are composed of small pebbles or other material and generally vary in composition

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<sup>1</sup>Data of Kearney, T. H., et al., from "Indicator Significance of Vegetation in Tooele Valley, Utah." *Jour. Agr. Res.*, Vol. 1, No. 5: 370-372. 1914.

<sup>2</sup>Cole, A. C. "The relation of *Pogonomyrmex occidentalis* to its habitat." (To be published in *Ohio Jour. Sci.*)

with the surrounding strata. The ants obtain their food by carrying seeds from nearby plants and storing them in more or less specialized chambers within the mounds.

### *The Salt Flats.*

These flats (Fig. 2) border the lake and are composed of a sandy stratum containing about two percent sodium chlorid. The flats adjoining the lake support no vegetation but as one proceeds toward the mountains distinct plant communities are observed on the salt flats, supporting *Allenrolfea occidentalis*, *Salicornia utahensis* and *Salicornia rubra* as dominant species. In these communities few and scattered mounds of *P. occidentalis* were observed. The mounds were, as a rule, small and distinctly cone-shaped and were situated in open spaces between plants. (Fig. 3).

Such a location is very different from normal upland habitats of the ant in soils of considerably less salinity. The brood is apparently well able to mature under extremely saline conditions. The stored seeds of greasewood and shadscale, carried from nearby areas, were grouped in chambers very near the surfaces of the mounds. By keeping the seeds dry in this manner germination was retarded to a marked degree. The brood chambers, however, were well under the surfaces of the mounds, sometimes at a depth of two feet, where the brood was all but bathed in the salt water from the lake. Such an unusual habitat serves to exemplify the plasticity of the mound-building instincts of the ant.

### *The Grass-Flat Communities.*

In these communities, where *Distichlis spicata*, *Sporobolus airoides* and *Chrysothamnus graveolens glabrata* dominate (Fig. 4), *P. occidentalis* mounds are few and widely scattered. At no time did I observe two mounds closely adjacent to one another. The mounds were always large, distinctly cone-shaped and with somewhat regularly-circular denuded areas usually cleared of all vegetation. In spite of the abundance of nearby seeds of *S. airoides* and *D. spicata* the ants were more inclined to harvest seeds of shadscale, greasewood and Russian thistle. These were found in chambers, often with the brood, at a depth of three to fourteen inches from the apexes of the mounds.

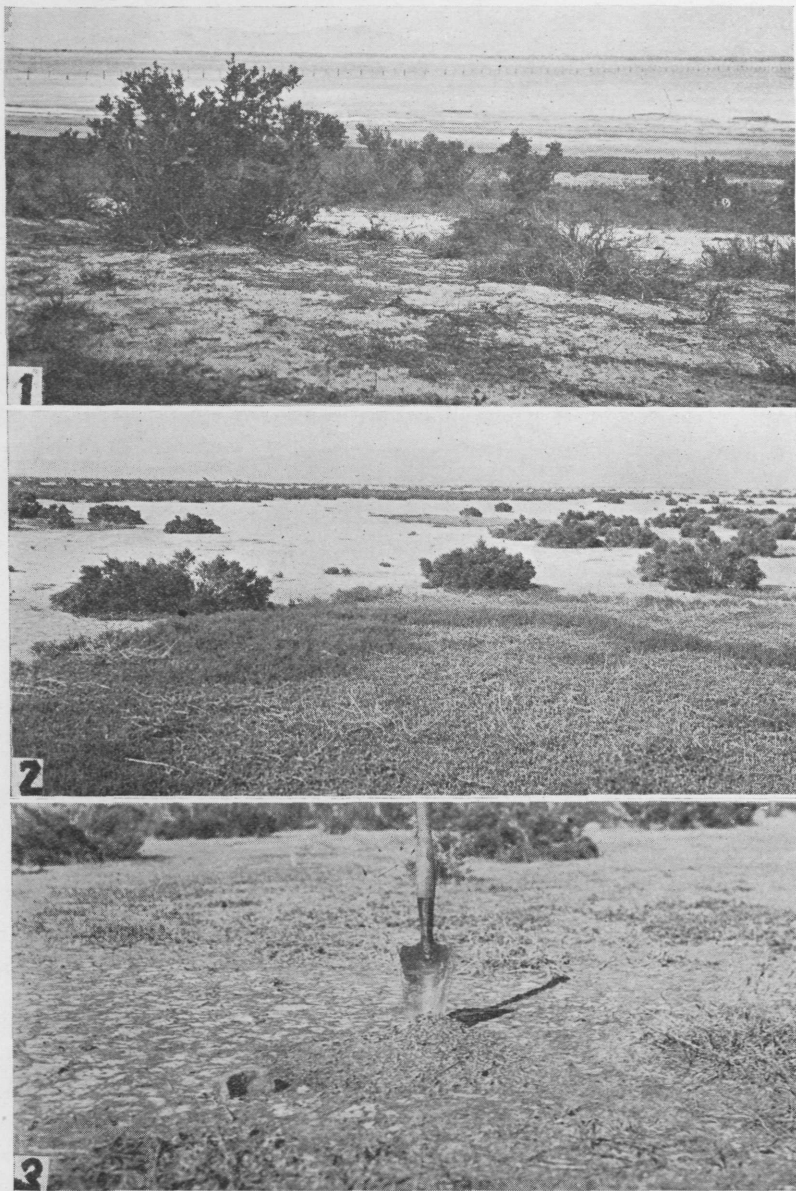


FIG. 1. Salt flats of Great Salt Lake, illustrating the zonal arrangement of vegetation. In the background is the *Allenrolfea* community and in the foreground clumps of greasewood. (Original).

FIG. 2. Salt flats of the Tooele Valley with wide expanses of bare areas in the background. The vegetation in the foreground is salt grass (*Distichlis spicata*) and in the background *Allenrolfea occidentalis*. (Original).

FIG. 3. Mound of *Pogonomyrmex occidentalis* in a community of *Allenrolfea occidentalis*. Tooele Valley, Utah. (Original).

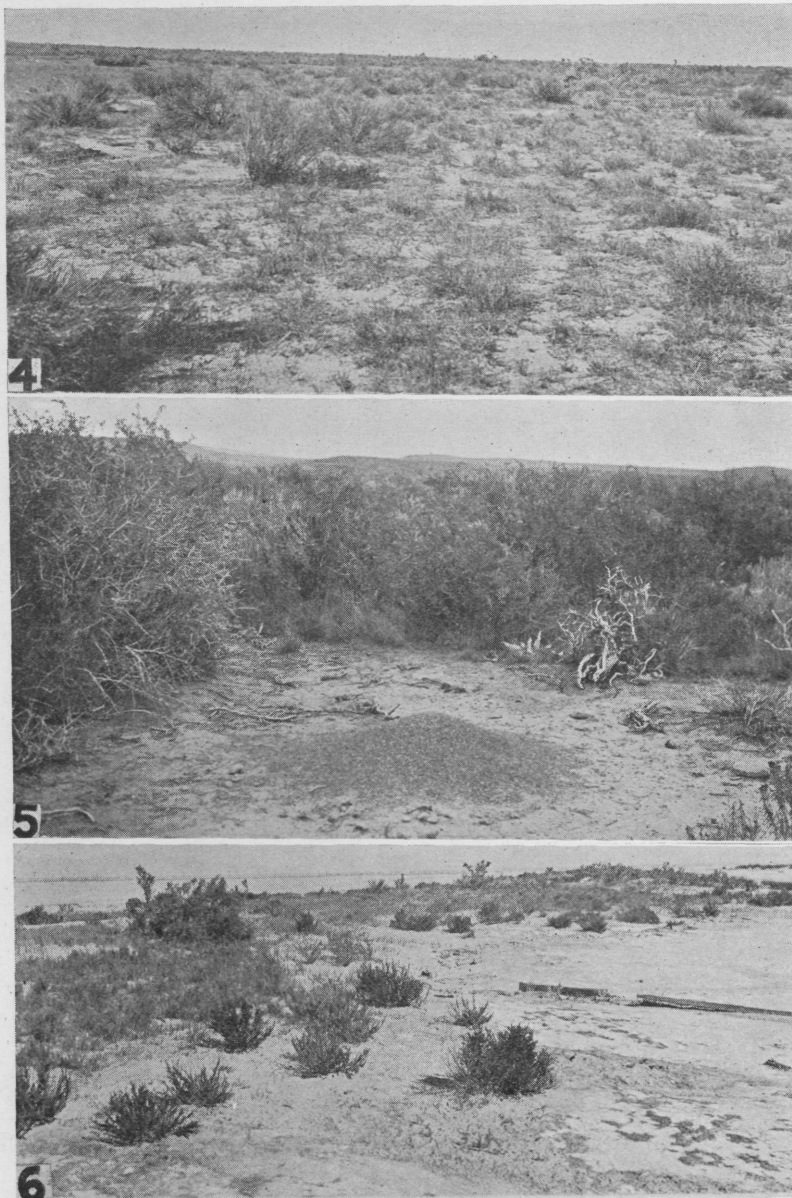


FIG. 4. The grass-flat community of Tooele Valley. Note the scattered plants of rabbitbrush (*Chrysothamnus graveolens glabrata*) associated with tussock grass (*Sporobolus airoides*). (Original).

FIG. 5. Mound of *Pogonomyrmex occidentalis* in the Greasewood-Shadscale Association. Note the large cleared area surrounding the mound. (Original).

FIG. 6. A mixture of vegetation extending out on the salt flats. The darker plants are those of greasewood (*Sarcobatus vermiculatus*). (Original).

### *The Greasewood-Shadscale Association.*<sup>3</sup>

This association is so termed from its dominant members, *Sarcobatus vermiculatus* and *Atriplex confertifolia*. It forms a wide belt across the valley between the grass flats and the schadscale association. Enough soil moisture is available for the survival and growth of greasewood and yet the upper two feet of surface soil are dry enough to support shadscale.

Mounds of *P. occidentalis* are comparatively abundant in this association (Fig. 5) averaging two feet in height and containing large numbers of workers and brood. As the vegetation of this association approaches the salt-flats the schadscale gradually disappears due to the increase in moisture content of the soil. Likewise, as the soil moisture becomes greater *occidentalis* mounds become fewer and, at the juncture described above, the average number of mounds correlates with that of the salt flat communities.

Seeds harvested by the ants consist chiefly of those of schadscale and greasewood together with those of *Bromus tectorum*, an annual typical of this association. They are lodged in chambers, with or without brood, in a position in about the centers of the mounds. The brood chambers are usually found at this level also but may extend below the ground level.

### *The Schadscale Association.*

Dominating is *Atriplex confertifolia* in a minor society of other vegetation including *Poa sandbergii*, *Kochia vestita*, *Opuntia* sp., *Artemisia spinescens* and *Lepidium jonesii*. *Occidentalis* mounds are only slightly more numerous than in the mixed greasewood-shadscale association and are most commonly found in somewhat open, grassy areas. Seeds harvested by the ants include those of *Poa sandbergii* together with those of greasewood and shadscale. The brood chambers, as well as the seed chambers, are situated near the bases of the mounds or often well under the ground level. The mounds are composed of pebbles and are often covered with a layer of chaff from harvested seeds.

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<sup>3</sup>The term "association" in this paper is used as defined by Kearney, T. H., et al. (*Jour. Agr. Res.*, Vol. 1, No. 5: 374, (1914), as "an assemblage of plants occupying a relatively uniform environment, having an easily recognizable appearance or 'physiognomy' and characterized by the predominance of one or a few species."

Large patches of short Russian thistle are succeeding some of the natural vegetation and in these "islands" many mounds of *P. occidentalis* are aggregated. Under these conditions the Russian thistle provides a great quantity of seeds which are harvested by the ants.

The shadscale of this association often extends out on the salt flats and usually terminates in a wild mixture of vegetation (Fig. 6). Many of these ridges also extend into the lake. In these places mounds of *occidentalis* follow the trend of the dominant and appear abundantly on the ridges.

#### *The Kochia Association.*

The *Kochia* association lies as a narrow, continuous belt extending across the valley between the shadscale area and the lower boundary of the typical sagebrush association. The plants are rather widely separated resulting in a large number of intervening bare areas from which most of the former grasses have been removed by pasturing. In such open areas mounds of *occidentalis* are occasionally to be found, their numbers, however, being far less than those of the preceding communities except perhaps the salt flats. Mounds of *occidentalis*, when they occur, are small, irregular and wind-blown, composed of earth instead of pebbles and consisting of only a comparatively few occupants. The brood chambers are proportionately small and irregularly situated throughout the mounds. The seed chambers are larger than the brood chambers and are often stocked with an abundance of shadscale, greasewood and Russian thistle seeds.

#### *The Sand-Hill Mixed Association.*

The sand-hill mixed association<sup>4</sup> is in the southern part of the valley. There a wide variety of vegetation, of which *Juniperus utahensis* and *Artemisia tridentata* are representative, grows on sand dunes or sandy ridges formed by the continuous sweep of the southwest winds. The stratum is almost pure sand some of which is in continuous motion. In such regions we should not expect to find *P. occidentalis* mounds in any great numbers. Only one mound was located and that partially protected from the wind by surrounding plants of sagebrush. This mound was in an incipient state and it is doubtful whether it would have ever become a more or less stable unit.

<sup>4</sup>Terminology of Kearney, et. al., *ibid.*

### *The Sagebrush Association.*

The sagebrush association is one of the most important vegetational units of Tooele Valley. It is found on the gently-sloping foothills and bench lands of the mountains, the alluvial fans and the sand hills. The dominant of this association is *Artemisia tridentata* which is associated with a number of other perennials as well as numerous annuals and biennials, among the most important being *Bromus tectorum* and *Erodium cicutarium*.

In this association *occidentalis* mounds reach their quantitative peak. In no other community do we find as many mounds so closely aggregated with one another and continually increasing in quantity. In fact, it is safe to estimate that there are approximately as many incipient colonies of the ant as there are fully developed mounds. The mature mounds are large, averaging two feet in height, and are surrounded by large cleared areas.

In pepper-grass (*Lepidium* sp.) "openings," scattered throughout the sagebrush association, the mounds were more closely aggregated than in any of the other areas of the association. In fact it is barely possible that the *Lepidium* in this locality started from the germination of seeds harvested by *occidentalis* workers from outlying areas, for, in many cases, the mounds as well as the denuded areas supported scattered individuals of the plant. Mounds of *occidentalis* opened in this area were found to contain large quantities of *Lepidium* seeds, often surpassing the number of *Bromus* seeds, though *Bromus tectorum* was extremely abundant throughout this association.

### *The Sagebrush-Juniper Community.*

The sagebrush-juniper community is a variation of the typical sagebrush association and is located on the lower mountain slopes. It also extends into the upper portion of Tooele Valley. In this community there is a marked deficiency in the number of mounds of *P. occidentalis* in spite of the more pebbly soil, common to areas of *occidentalis* abundance. Scattered mounds were found in the more open areas between the junipers. These contained large quantities of *Bromus tectorum* seed, commonly present in the community.

## CRATERS OF THE MOON NATIONAL MONUMENT, IDAHO.

*The Area in General.*

Craters of the Moon National Monument lies 26 miles southwest of Arco, Idaho. The soil of the region is largely composed of cinders formed of basalt lava from both aa and pahoehoe lava flows.<sup>1</sup> The pahoehoe type covers about half of the area of the Monument. It affords a smooth, billowy appearance very distinct from the rough, jagged aa flow which occupies the remainder of the area. Many hills of cinders which originated from adjacent cinder cones dominate the landscape. On these hills most of the vegetation is found.

If Irving<sup>2</sup> refers, as Stearnes<sup>3</sup> believes, to the Monument as "an area of about 60 miles in diameter, where nothing meets the eye but a desolate and awful waste, where no grass grows, nor water runs, and where nothing is to be seen but lava," he made far from accurate observations of the area. The vegetation is surprisingly abundant and is separated into various and distinct plant communities. These communities are arranged as various zones in the Monument, their positions apparently determined by soil texture, moisture and hydrogen-ion concentration.

*The Semi-desert Communities.*

## 1. The Sagebrush Community:

The sagebrush community is one of the most prominent vegetational units of the region. It occupies, in pure stands, many areas within the Monument but as a rule it is found on the cinder buttes. In association with the dominant sagebrush are *Agropyron repens*, *Agropyron smithii*, *Purshiana tridentata* (buck bush), *Chrysothamnus graveolens* (rabbit brush) and *Bromus tectorum* (brome grass).

In the sagebrush community mounds of *Pogonomyrmex occidentalis* are found in greater abundance than at any other point in the limits of the Monument. The majority of them are of average size, about two feet in height and three and

<sup>1</sup>Stearns, H. T., *A Guide to the Craters of the Moon National Monument, Idaho*. Bull. Idaho Bur. Mines & Geology, XIII (1928), 7-59.

<sup>2</sup>Irving, Washington, *The Adventures of Captain Bonneville*. U. S. A., Hudson ed., New York, 1868, 203.

<sup>3</sup>Stearns, op. cit., p. 7.



one-half feet in diameter, and are surrounded by large areas from which the vegetation has been cleared by the ants. Most of the mounds are composed of cinders which offer fair insulation of the brood in chambers at the bases of the structures.

## 2. The Sub-alpine Meadows:

On the tops and upper slopes of the higher hills are quite dense meadows of the following vegetation:<sup>4</sup>

### GRASSES

<i>Ericoma hymenoides</i> (Indian millet).	<i>Melica bella</i> (rye grass).
<i>Oryzopsis bloomeri</i> (wild rice).	<i>Sitanion rigidum</i> .
<i>Sitanion cinereum</i> .	<i>Stipa comata</i> (spear grass).
<i>Stipa occidentalis</i> .	

### SHRUBS AND HERBS.

<i>Agoseris</i> sp. (goat chicory).	<i>Amelanchier alnifolia</i> (service berry).
<i>Castilleja pinetorum</i> (paint brush).	<i>Cirsium orthe</i> (Canadian thistle).
<i>Cryptantha torreyana</i> (borage).	<i>Eriogonum aridum</i> .
<i>Eriogonum depressum</i> .	<i>Eriogonum ovalifolium</i> .
<i>Eriogonum subalpinum</i> .	<i>Eriogonum vimineum</i> .
<i>Eupatorium occidentale</i> (boneset).	<i>Galium boreale</i> (bedstraw).
<i>Crepis acuminata</i> .	<i>Coleosanthus grandiflorus</i> .
<i>Gayophytum ramosissimum</i> .	<i>Heuchera ovalifolia</i> (alum root).
<i>Lewisia redeviva</i> (bitter root).	<i>Lupinus tenulus</i> (lupine).
<i>Lygodesmia spinosa</i> (prairie pink).	<i>Opuntia polycantha</i> (cactus).
<i>Opuntia xanthostemma</i> (cactus).	<i>Oreocarya dolosa</i> (borage).
<i>Pentstemon deustus</i> .	<i>Philoria tenuifolia</i> (desert pink).
<i>Potentilla biennis</i> (cinquefoil).	<i>Potentilla dichroma</i> .
<i>Salsola pestifer</i> (Russian thistle).	<i>Ribes cereum</i> (currant).

In spite of the abundance and the wide variety of vegetation *occidentalis* mounds are very scarce, only an occasional colony being found. In mounds which were opened the seed chambers were in about the centers of the mounds and were stocked with seeds of many of the plants listed above.

## The Laval Plant Communities.<sup>5</sup>

### 1. The Cinder Meadows:

The cinder meadows<sup>6</sup> are usually located on the slopes of the cinder buttes and rarely on the sides of the spatter-cones.<sup>7</sup> The representative vegetation is not abundant but *Lewisia redeviva*, *Mimulus nanus*, *Eriogonum depressum*, *Eriogonum aridum*, and *Eriogonum ovalifolium* are outstanding plants.

<sup>4</sup>Ibid.

<sup>5</sup>Terminology of the author.

<sup>6</sup>Ibid.

<sup>7</sup>Stearns, op. cit., p. 23.

The few and scattered mounds of *P. occidentalis* in the cinder meadow community are small and irregularly constructed, with few workers and little brood. The seeds stored in the somewhat specialized seed chambers represent those of *Salsola pestifer*, *Stipa comata*, and *Stipa occidentalis* and not those of plants dominating the meadows. From the appearance of the mounds and the environmental conditions under which they survive the somewhat recent invasion of the ant is evident.

## 2. The Pine Community:

The pine community is probably the least important and most poorly represented community of the Mounment. The dominant, *Pinus flexilis*, (limber pine), never exists in pure stands at the Craters of the Moon. Unfavorable environmental factors have dwarfed and twisted the trees and have limited their numbers and spread. The limber pine is better adapted to growing on the cinders than on the lava<sup>8</sup> and it is there that it is found in its greatest numbers. Associated with *Pinus flexilis* are *Prunus melanocarpa* (choke cherry), and *Amelanchier alnifolia* (service berry) as well as *Artemisia tridentata* (sagebrush) and *Chrysothamnus graveolens* (rabbit brush).

*Pogonomyrmex occidentalis* is represented in the community by a few mounds usually scattered in the interspaces of the sagebrush plants but occasionally at the bases of the pines. The mounds are small, irregular in outline and composed of coarse cinders. The brood chambers are small, few in number and dispersed throughout the mounds. The chief seeds harvested by the ants are those of *Amelanchier alnifolia* and *Salsola pestifer*.

### *The Alpine Groves.*

Small stands of quaking aspen, *Populus tremuloides*, grow on the slopes of Big Cinder and Fissure Buttes, two prominent cinder cones of the region, where the snow lies late in the spring. Only a few plants are associated with *Populus tremuloides* in the community, among the more outstanding being *Stipa comata* and *Agropyron spp.*

Of the limited number of mounds of *P. occidentalis* present in the community all are in the large bare areas between the vegetation. They are generally small and somewhat incon-

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<sup>8</sup>Ibid., p. 50.

spicuous, without definite cone-shaped outlines and with only slight denuded areas. The brood chambers and the seed chambers are few in number and are irregularly located throughout the mounds, many of them even below the ground level.

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