# Range Vegetation and Mima Mounds in North Texas

BROWN COLLINS

**Highlight:** *Mima mounds are found in many areas west of the Mississippi River. The polygenetic origin of mounds in different areas is commonly accepted. The formation of these mounds in the Blackland Prairie may be associated with past climatic changes in the area, and resultant erosion and vegetational changes.*

## Mima Mounds: Description and Distribution

Microrelief topography, consisting of many closely spaced mounds, is a conspicuous feature of many states west of the Mississippi River (they have never been reported east of the Mississippi River). These mounds are generally called "mima mounds" in the Pacific Northwest, "hogwallows" in California, "pimple mounds" in Texas and "prairie mounds" in other places. In this paper they will be referred to as mima mounds.

Mounds are extensive along the Gulf Coast Plain of Texas and Louisiana, the Columbian Plateau and Puget Sound lowlands in the Pacific Northwest, and the Central Valley of California. They have been reported in 18 states on 20 different geomorphic units (Holland et al., 1952).

Mounds are similar in size, shape, and distribution regardless of the region in which they are found or the geologic material on which they have formed. They have an average diameter of 30 to 40 feet and an average height of 3 to 4 feet (Fig. 1). Mound shape is rather uniform, being nearly round on level surfaces and elliptical on slopes (Ritchie, 1953).

The composition and interior structure of the mima mounds varies considerably from place to place. In the more northern regions of occurrence, they are composed of glacial till, mainly silty and loamy soils with some gravels and pebbles. In other areas they are composed mainly of silt loams, loams, and clay loams. A few are reported to be sandy; none are clayey. Mima mounds are classified as aquic paleudolls and aquic argiudolls under the current system of soil classification. Allgood and Gray (1973) feel they would be better described with a seismic modifer. Mima mounds are found in the northern portion of the Blackland Prairie of Texas (Collins, 1972). Aronow (1968) has projected a commonly accepted theory of origin for Texas coastal mima mounds. This paper is an attempt to provide insight into the origin of mima mounds in north Texas.

## Previous Theories of Origin

The Caddo Indians had a legend regarding the formation of mima mounds (Krinitzsky, 1949), but the earliest recorded reference was probably made in 1843 (Newcomb, 1952). Since that time there have been many theories concerning mound formation. As late as 1952, there were at least 25 theories of mound formation which had support in some quarters (Holland et al., 1952). However, most theories were based on cursory observation rather than scientific study.

In recent years, a few theories of mima mound origin, based on scientific study, have been commonly accepted in most areas. The Patterned Ground Theory is accepted in the Pacific Northwest (Péwé, 1948;

**Fig. 1.** *Blackland Prairie mima mounds in a native hay meadow. Sporobolus silveanus is the dominant species in this meadow. Note the gopher activity evident in the mound in the lower portion of the photo. (Soil Conservation Service photo)*

The author is plant ecologist, Dames & Moore, Houston, Texas.

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Ritchie, 1953; Malde, 1964). In the Central Valley of California, along the base of the Sierra Nevada Mountains, the Hydrostatic Pressure Theory is popular (Nikiforoff, 1941; Retzer, 1945). A recent study of landscape features of the Texas Gulf Coast by Aronow (1968) resulted in a theory of "Landscape Deterioration."

The Patterned Ground Theory is based on the concept that a network of polygonal-fissured ice could have developed on the landscape early in the last ice recession. As the landscape began to thaw, the meltwater removed the glacial till from around the still frozen hemispheroidal cores of each polygon. When these cores melted they formed the mima mounds.

The Hydrostatic Pressure Theory is based on observations made while studying the soil profiles of the mounds and intermound areas. "Holes" were observed to occur in the hardpan where it passed beneath the mounds. It was theorized that the hardpan predated the mounds, and that hydrostatic pressure of groundwater descending from steep slopes of the high Sierras into the relatively flat plain of the Central Valley forced the groundwater up through the "holes" in the hardpan. As water seeped upward, it carried subsoil material which formed the mounds. This could have happened during final deglaciation in the mountains, when meltwater was plentiful.

The Landscape Deterioration Theory offers an explanation for the formation of pimple mounds on the Coastal Plain. Mounds are restricted in this region to Pleistocene and possibly early Recent surfaces with slopes less than 10 feet per mile. They occur on relict fluviatile deposits (especially levee and point bar), barrier islands, and anomalously lagoonal deposits. In this region mima mounds gradually disappear with time.

Mima mound origin has been attributed to gopher (*Geomys* or *Thomomys*) activity in Washington (Dalaquest and Scheffer, 1942), California (Arkley and Brown, 1954), and Minnesota (Ross et al., 1968). The gopher theory may be succinctly stated by asking which came first, the gopher or the mound. However, it is difficult to imagine gophers producing 40,000,000 mima mounds (Cain, 1974).

## Present Status of North Texas Origin Theories

Although a myriad of hypotheses have been projected concerning mima mounds in north Texas, no specific theory of mima mound formation is commonly accepted.[1] Theories of erosion and accumulation are currently the most widely accepted. The erosional theory suggests that the removal of the intermound area by running water and wind has left the mounds as essentially residual forms (Featherman, 1872; Holland et al., 1952; Goebel, 1971). Goebel (1971) postulated that mima mounds in north Texas primarily result from a low stream-base profile and the low angle of regional dip. However, Cain (1974) discounted strike and dip factors in a similar location because they are horizontal. Cain also points out that mima mound spacing is not random and, therefore, cannot result from rill erosion around chance nuclei. Vegetation is not characteristically randomly dispersed (Greig-Smith, 1964).

The Accumulational Theory (Olmstead, 1963; Cain, 1974) projected the concept that bunch grasses, small shrubs or trees served as centers of accumulation of wind-blown soil and silt. Bailey (1892) discounted most other theories for mima mound formation in the Blackland Prairie: "all are on rolling land and not flood land.... They are clay soil [sic][2] so cannot be dunes.... Are too numerous for human work, too large for animal mounds, unless made by Megatherium. Are too circular and even for iceberg or glacier deposits."

## New Support for the Accumulating Theory

The *Sporobolus-Tridens–Paspalum* community type covers the portion of the Blackland Prairie of Texas where mima mounds are common (Collins, 1972). The prominence of *Sporobolus silveanus* on this community type may offer insight to the origin of the mounds.

The last ice sheet retreated from the northern fringe of the area now recognized as the North American Midcontinental Grasslands about 10,000 years ago (Kupsch, 1960). The retreat was followed by a warming trend which lasted from about 8,000 B.C. to the beginning of the Christian era (Dix, 1964) and is recognized as the Hypsithermal period (Deevy and Flint, 1957). During the Hypsithermal period, the deciduous forest retreated eastward and grasslands occupied the vacated area. Some members of the forest flora, especially grasses, withstood the climatic change. These species survived, reproduced, and integrated with the grassland flora (Dix, 1964). Gleason (1923) noted that the three most important grass genera (*Andropogon, Sorghastrum,* and *Panicum*) in the Illinois Tall-Grass Prairie, plus *Sporobolus* to the south, belong to this group. There has been some question concerning the Hypsithermal (forest-retreat) influence on the vegetation of Texas (Graham and Heimsch, 1960), but, if any area of Texas was affected, it would have been the northern portion of the Blackland Prairie.

Dominant species on the *Sporobolus-Tridens-Paspalum* community type have been identified with wooded or mesic situations (Hitchcock, 1950; Launchbaugh, 1955). It is quite possible that these species, or their ancestors, developed as dominants following the forest retreat to the south and east.

A forest-retreat origin of the vegetation would seem to support the Accumulational Theory of mima mound formation. This theory is founded on the belief that, once the surface horizon(s) had developed, the climate of the area became arid and vegetation became discontinuous. Deflation of the surface soil occurred on the barren areas and accumulated around clumps of remaining vegetation. When humid conditions returned, a new profile formed between the mounds. The erosional periods may have been during the arid period which caused the forest to retreat eastward, since wind erosion is prevalent in arid situations (Holland et al., 1952). This conclusion is in agreement with findings of Cain (1974). After extensive study, he postulated that mima mounds in southwestern Louisiana were the result of erosional action depositing material at the base of trees. Instead of Hypsithermal period influence, Cain suggests the gran seco catastrophe of

[1] Personal communication from Saul Aronow (1974).

[2] Emphasis by author.

Darwin (1845). He correlates mound alignment and regular spacing to a vegetational-erosional origin.

Present day examples of vegetation-erosional mound origin are found in Coppice Dunes and Rotura Soil near Las Cruces, New Mexico (Gile, 1966; 1967). The mima mounds of northeast Texas may well have had a similar origin.

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