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ANALYSIS OF DUST TRAP SEDIMENTS COLLECTED ON THE SOUTHERN HIGH PLAINS

by

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Preliminary data derived from six dust traps installed on the Southern High Plains show that dust deposition varies locally and seasonally in response to natural and man-induced factors. Monthly rates of dustfall at individual stations ranged from 0.658 gm/m^2 at Muleshoe to 13.441 gm/m^2 at Palo Duro Canyon. Dust deposition contributes significantly to the renewal of the High Plains surface.

The Southern High Plains has been identified as the dustiest region in the contiguous U.S.A. (Orgill and Sehmel, 1976). Sources of dust are numerous and include desiccated playa bottoms, sand dunes, floodplain deposits, plowed fields, overgrazed rangeland, and unpaved roads. Ambient dust deposition is a continuous process augmented by rapid influx of material during duststorms and precipitation events. This study focuses on the amount and characteristics of present-day ambient dustfall. This information is necessary to assess the influence of future eolian deposition and its effect on landscape evolution over the expected life-span of a high-level nuclear waste repository.

Six dust collectors, consisting of quart-sized, glass canning jars with screened openings, and glycerol as the trapping medium, were installed at preestablished weather-monitoring stations (fig. 1). The traps were designed to collect material deposited by gravitational settling and were mounted at heights of 135 to 147 cm above ground level. The collection sites were chosen to represent natural conditions as accurately as possible.

Dust collection was initiated in February 1983 and is expected to continue for 3 to 5 yr. Samples are collected monthly (29 $\pm$ 3 days), and analyzed for dust quantity, mineralogic composition, and grain-size distribution. Dustfall values are reported as D, gms x m^{-2} x month^{-1} (American Society for Testing and Materials, 1979).

Preliminary results show that the quantity of dust varies greatly between stations (fig. 2). As regional weather patterns are fairly homogeneous over this physiographic province, local differences in soils, land-use practices, vegetation density, topography, and subsequent wind flow account for the variations.

The Palo Duro site collects significantly greater amounts of dust owing to its geographical setting. The collector is situated 15 ft (5 m) from the top of the eastern Caprock Escarpment, a nearly vertical drop of 440 ft (130 m). The "scarp effect" (Bowen and Findley, 1974) causes wind speeds to increase dramatically as currents are forced up the escarpment, thereby increasing their dust-entrainment capacity. Wind velocity drops suddenly at the top of the escarpment, as flow spreads laterally across the High Plains surface. Not surprisingly, the Palo Duro station also collects a larger percentage of coarse eolian material than do the other stations (fig. 3).

The increase in collected dustfall between April and May is a seasonal effect attributable to the passage of frontal systems from the west, combined with agricultural practices. Large tracts of bare, unconsolidated soil resulting from spring plowing create sources for fine silt and clay during the windy months. Duststorms in the South Central states occur with greatest frequency in February, March, and April (McCauley and others, 1981; Orgill and Sehmel, 1976) and transport vast quantities of dust far from the original source areas.

Rainfall events can cause fine particulates to be washed out of suspension (Smith and others, 1970; Yaalon and Ganor, 1973). In general, there is a positive correlation between dust deposition and monthly rainfall (fig. 4). It appears, however, that for each station there exists a "threshold" rainfall amount, above which the effects of increased vegetation growth inhibit dust generation. More data are needed to quantify this effect.

Dust deposition has been and continues to be an active process on a worldwide basis (Yaalon and Ganor, 1973; Péwé, 1981) and especially on the Southern High Plains as shown by the preliminary results of this study. The contribution of dust to the processes of caliche formation, soil renewal, and topographic modification should be investigated further to assess its impact.

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Figure Captions

Figure 1. Physiography of the Texas Panhandle, and location of dust collection sites. (1) Buffalo Lake National Wildlife Refuge, (2) Palo Duro Canyon State Park, (3) Muleshoe National Wildlife Refuge, (4) Caprock Canyons State Park (2 traps), and (5) Lake Meredith National Recreation Area.

Figure 2. Monthly dustfall at six collection sites.

Figure 3. Grain-size distributions of dust samples collected on the Southern High Plains.

Figure 4. Relationship between monthly dustfall and rainfall. The variables are positively correlated up to a certain "threshold" rainfall value unique to each station.

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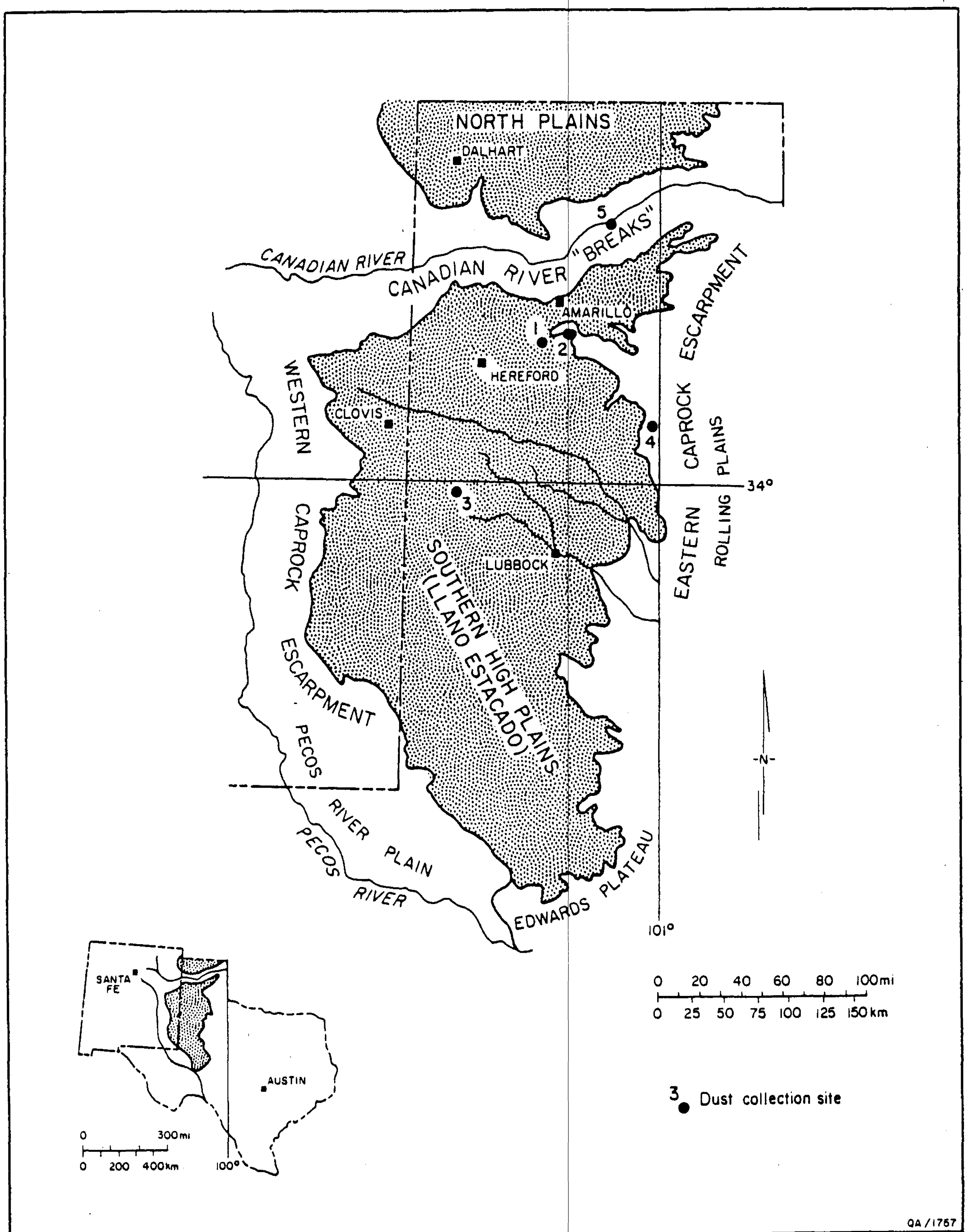

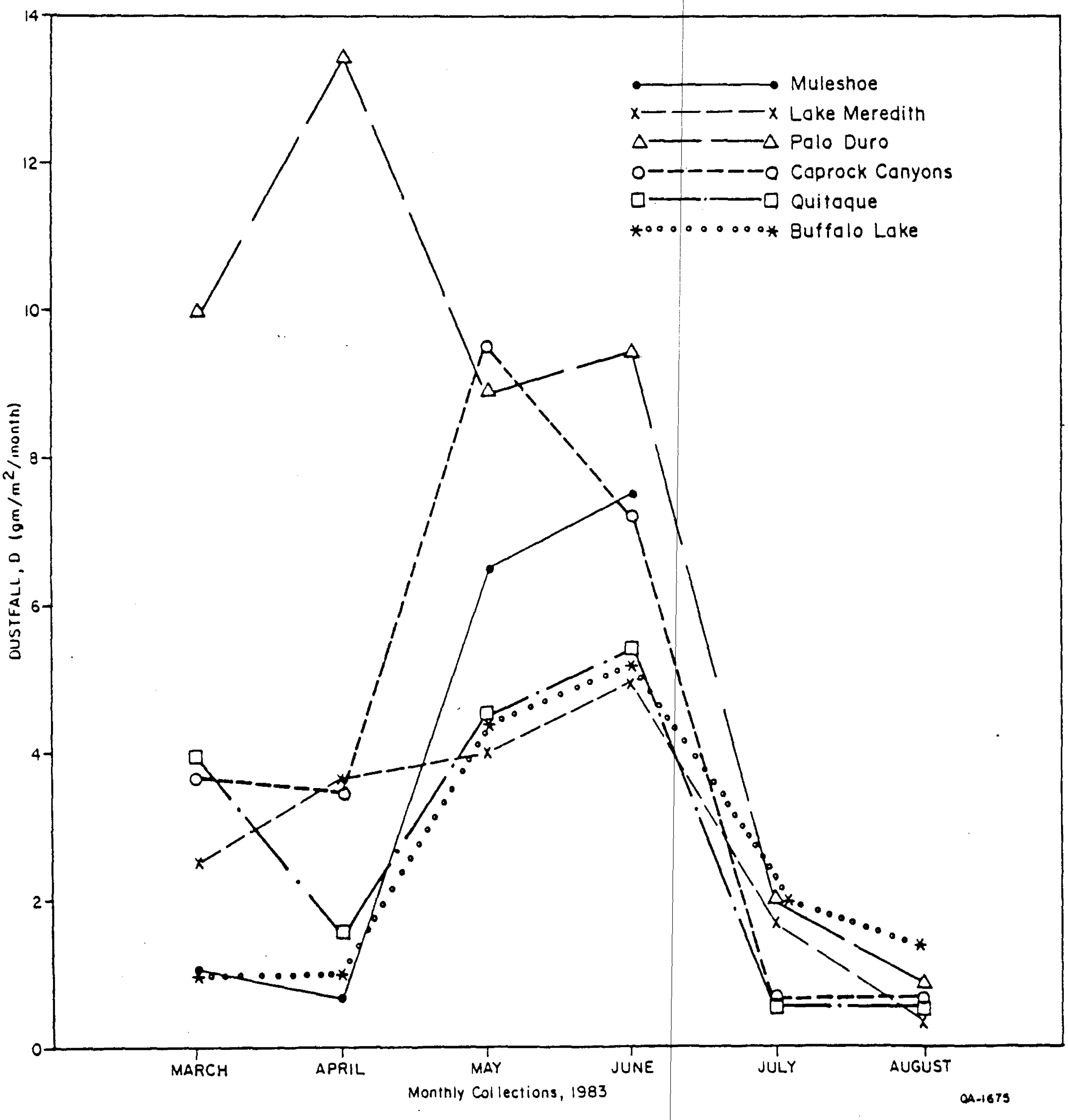

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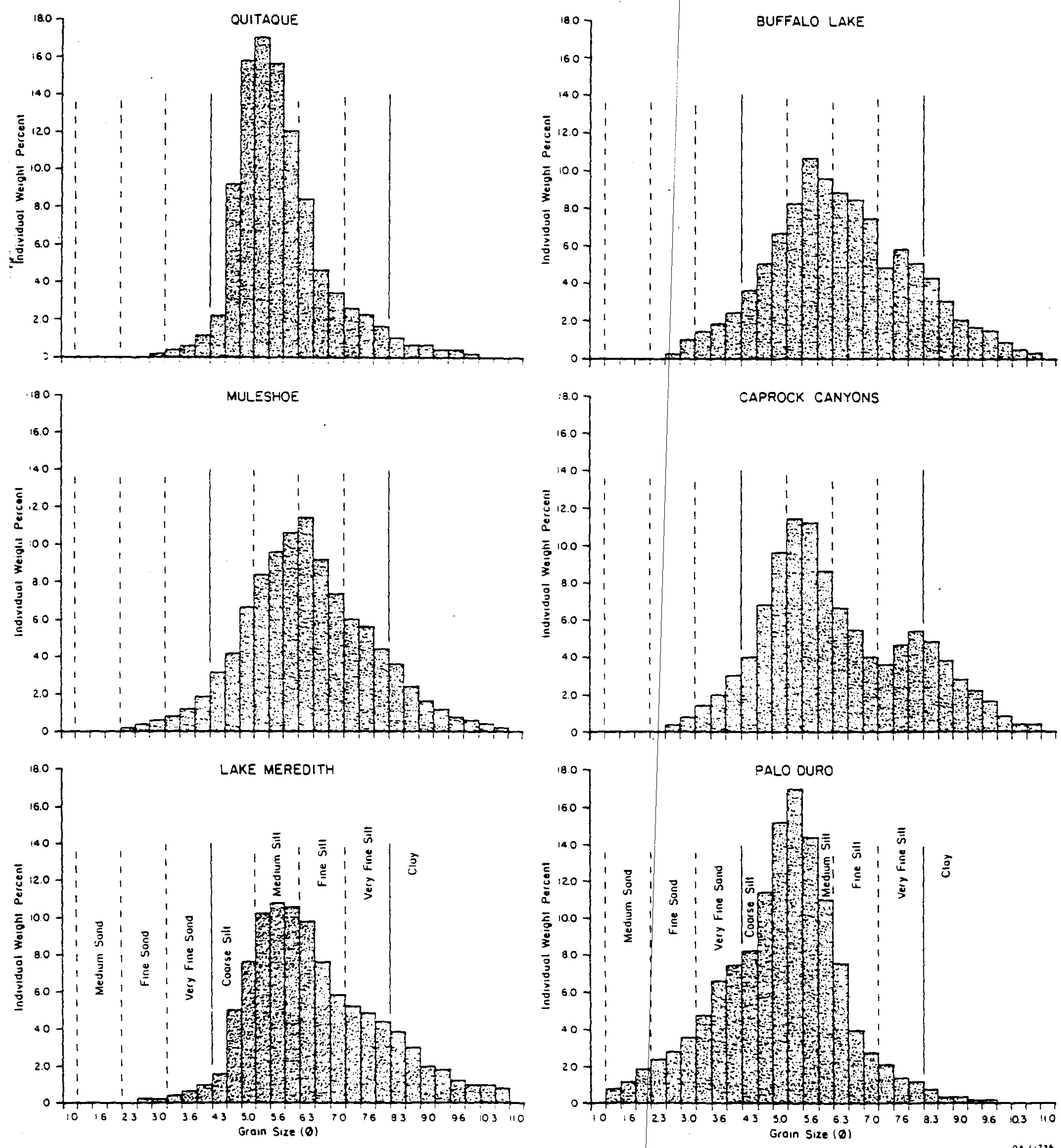

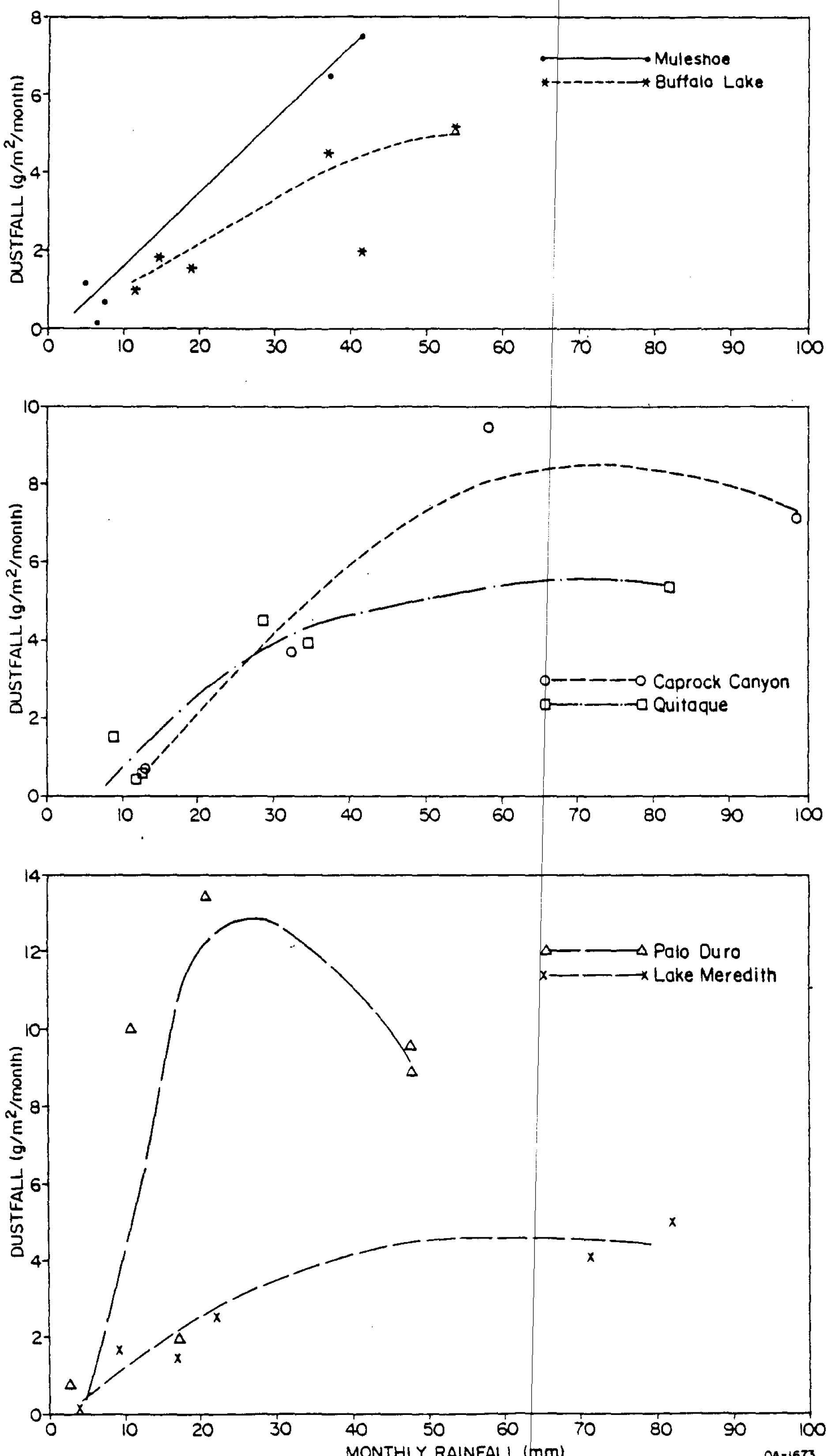

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