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## Geochemistry and potential playa sources of the January 7, 2008 Southwestern New Mexico "milky rain"

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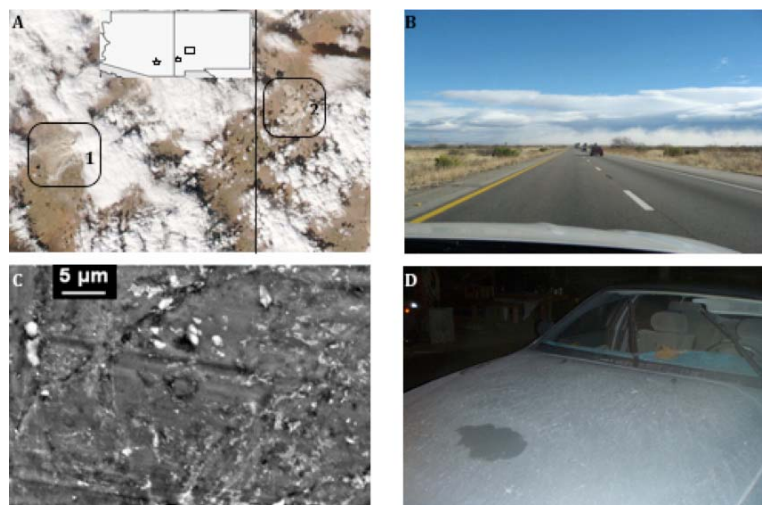
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On the afternoon of January 7, 2008, an approximately 1300 km<sup>2</sup> region of Grant County, New Mexico, USA (Figure 1A), was subject to an unusual rainfall of milky-white color that left a hard, solid residue on surfaces (Figure 1D). Concerned residents, who collected samples from cisterns, rain gauges, and roof runoff, contacted area universities and state agencies to arrange for chemical analyses. Initial speculation of the source targeted everything from local mine tailings to Pacific Rim volcanic ash. Scientific evaluation of wind back trajectories, MODIS satellite images, and photographic observations indicated a possible regional source mechanism: wind erosion and transport of whitish dust from Willcox Playa in southeastern Arizona, USA (Figure 1B), followed by downwind entrainment into clouds, nucleation and wet deposition in localized rain showers downwind. Other rare "milky rain" events worldwide were traced to rainout of dust from saline lake basins (Resane, T.H. et al. 2004, South African Journal of Science 100: 483-487), and plumes of Willcox Playa dust have been previously observed to have been advected above the region as aerosols. Milky rain pH was 7.20 compared with the

regional average of 5.66. Electrical conductivity ranged from 46.5 to 115  $\mu\text{S}/\text{cm}$  as opposed to an average of 4.3  $\mu\text{S}/\text{cm}$  for the region. Analysis of major ions indicated elevated levels of calcium, magnesium, sodium, potassium, sulfate and chloride, as would be expected in playa-type deposits. A National Atmospheric Deposition Program site at the Gila Cliff Dwellings determined the calcium concentration of the rain (5.8 mg/l) to be within the top 1.0% of all data gathered by the network in a typical 5 year period. Upon analysis, the New Mexico Environment Department concluded that the event samples had similar chemistry to surface water samples obtained from the Lordsburg Playas in the early 1990s and reassured the public regarding its possible (non-) toxicity; the Lordsburg Playas (a known dust source along the same trajectory between the affected region and Willcox Playa) may have also contributed to this event. SEM analysis of water filter residue (insolubles and precipitates) from the event showed particles  $\leq 1 \mu\text{m}$  in diameter (Figure 1C) with an elemental composition (Si, Al, Ca, and Mg) consistent with aluminosilicate and evaporite minerals.



**Figure 1**—A: MODIS satellite image of the event showing plumes of dust rising off the Willcox Playa (1) and location of Lordsburg Playas (circle) and area affected by milky rain (square) (2). B: Dust plumes moving right to left (south to north) across Interstate Highway 10. The image was coincidentally taken on day of event. Willcox Playa is just off image to right. C: Scanning electron micrograph of filter residue. D: Image of dried residue left on car hood (Photo courtesy of Alyson Siwik).