

## **One batch or two?**

### ***Particle size in the anthrax mailings***

Paul de Armond, Public Good Project © 2002

#### **Distinct differences in the powders**

The anthrax mailings appear to have involved two or perhaps three separate mailings. The first three letters went to the *New York Post*, NBC in New York and American Media, Inc. in Florida. The second group of letters were mailed to the U.S. Senate.

The Post and NBC letters contained coarse powder described as “clumpy and rugged... like Purina Dog Chow.” No inhalatory infections resulted from these two letters. The Post anthrax reportedly contained dead anthrax cells and other inert debris and only about 10% spores.

The Florida letter contained a mixture of coarse and fine powders. Two inhalatory infections, one fatal, and the culture swab tests conducted by the EPA show this letter contained some fine particles. No sample of powder was reported to be recovered from the AMI offices.

The two letters to Washington D.C. contained fine powder small enough to cause four deaths from inhalatory infections and is described as “100% pure spores

The epidemiological evidence shows the New York and Florida letters were mailed at or about the same time. The first reported infection occurred at the Post. The onset of Robert Stevens symptoms was a day or two later. Allowing for the delay in the mail due to the old address of the National Enquirer on the Florida letter, it is likely the first three letters were mailed at the same time. The attacker was evidently aware of the difference between the powder in the two batches of letters, since the two recovered letters to the Post and NBC suggested the recipient “take penacilin [sic]now.” The Senate letters mailed after Robert Stevens’ death .said “you die now.”

This suggests the attacker was more than willing to commit multiple murders, aware the powder was deadly, and also aware the later mailing was more deadly than the first.

#### **How to explain the difference in the powders?**

Some people have speculated the difference in particle size means two separate batches of anthrax. This explanation is unsatisfactory for several reasons. First of all, the weaponization process most consistent with the reported characteristics of the attackers anthrax uses spray drying. This process is not amenable to producing small amounts. Secondly, there is no reported difference in the genetic substrain, the chemical additives or any characteristic other than particle size. This difference is the only evidence cited for supposing two batches were produced. And two batches are unnecessary to explain the differing particle sizes.

A better explanation is the attacker produced or obtained a single quantity of anthrax powder and the different particle sizes were the result of the weaponization process. The separation of particle sizes may have occurred by happenstance or it may have been assisted by the attacker. The different texts of the letters indicates the attacker knew the second mailing contained a deadlier powder and by inference the attacker also knew of the difference in particle sizes. Eyewitnesses to the New York and Washington powders were able to discern the difference. It was also apparent to the attacker.

### **How particle size separation can happen**

Powders naturally separate by particle size. If a mixture of different powders is lightly shaken, the particles will move about until they occupy the least amount of space. Small particles will fall into gaps where they fit. This process, if continued long enough, will produce a gradient of particle sizes with coarse particles at the top and fine particles at the bottom.

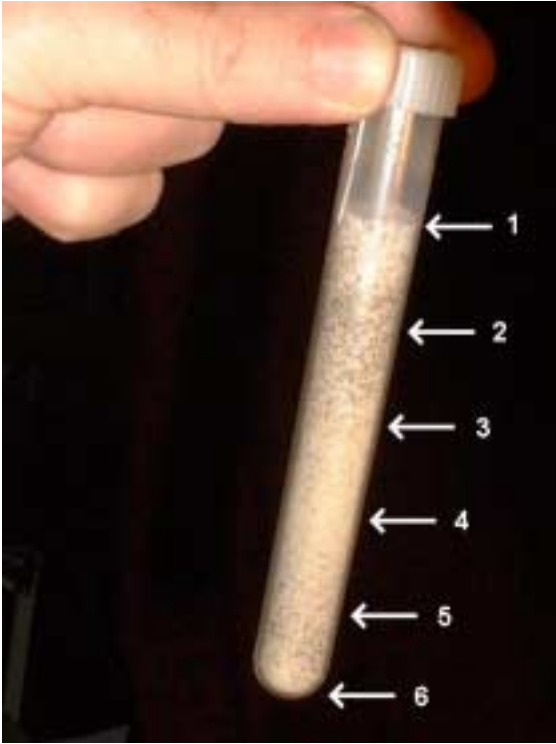
A simple kitchen table experiment demonstrates this process. Take equal measures of salt and pepper. Salt has regular cubic crystals of constant size. Ground pepper is a mixture of different sized particles and is easily distinguished from salt by the naked eye. Put the salt and pepper in a small container. Vibrate it gently. With the right vibration, the powder will separate by particle size. Because salt crystals are larger than most pepper particles, it rises to the top. With careful shaking, a layer of nearly pure salt will form on the top.

This is similar to what may have happened to the anthrax powder. The vibration of carrying it around could have been enough to cause the separation, particularly if it was carried or transported for a long enough time. Anthrax cells are slightly fatter than spores and about ten times as long. The larger “clumpy” particles containing mostly dead anthrax cells and relatively few spores correspond to the salt rising to the top of the tube. The smaller particles consisting of spores correspond to the pepper poser at the bottom.

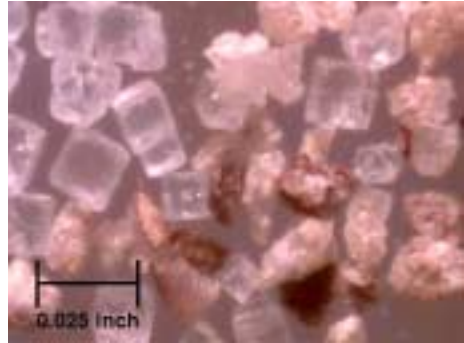
The accompanying microphotographs show the mixture of particle sizes. It is clear that the shaking separated the particles by size. More importantly, if this mixture was poured out into five portions, the sequence of particle sizes would match the range observed in the letters: the first and second portions correspond to the New York letters; the third portion shows finer particles beginning to appear as was observed in the Florida letter; and the final two portions contain the finest powder, as was the case in the letters sent to the Senate.

Shaking is not the only process for separating powders. It is possible that fine-mesh screens could have been used. These would cause sharper jumps in the particle size, but this would match the sequence of sizes in the anthrax case if the powder which fell through the screen was put in one container and the remainder went into another. There would still be some separation on shaking the powder out into the envelopes if the same filling sequence of New York, Florida and Washington was followed.

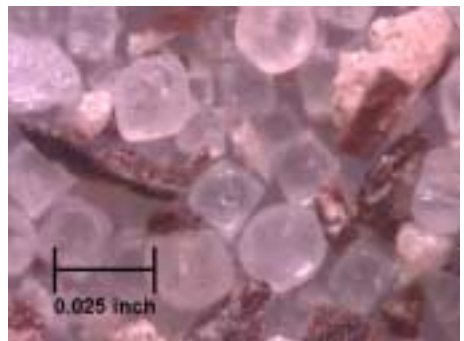
# Distribution of particle size by physical separation



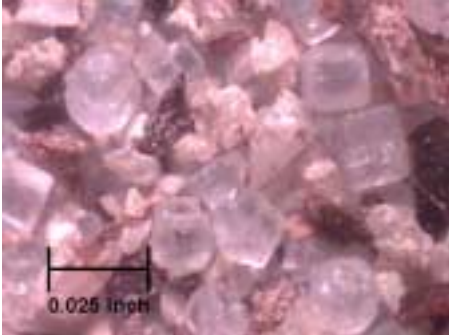
After shaking, the mixture shows clear bands of separation



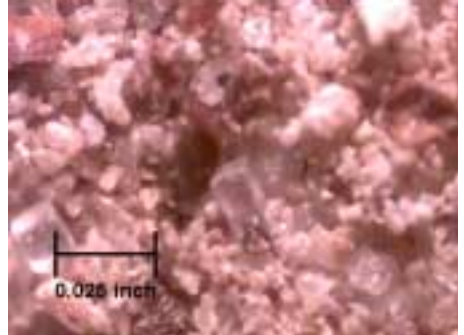
1 The larger salt crystals predominate



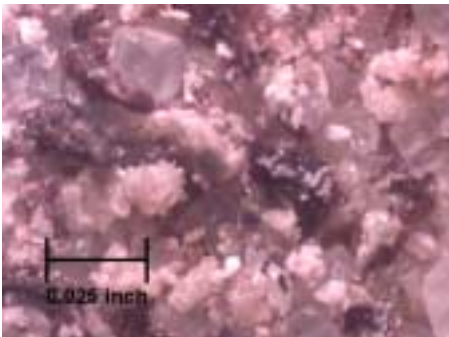
2 Upper fifth is mostly salt



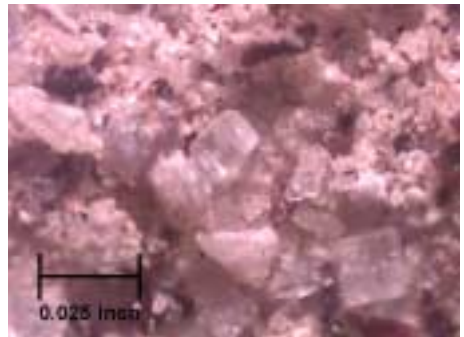
3 Smaller particles begin to appear



4 Fine powder begins to predominate



5 Very fine powder, few large particles



6 The finest particles collect at the bottom

## The text of the letters with the coarse powder

09-11-01  
THIS IS NEXT  
TAKE PENACILIN NOW  
DEATH TO AMERICA  
DEATH TO ISRAEL  
ALLAH IS GREAT

## The text of the letters with the fine powder

09-11-01  
YOU CAN NOT STOP US.  
WE HAVE THIS ANTHRAX.  
YOU DIE NOW.  
ARE YOU AFRAID?  
DEATH TO AMERICA.  
DEATH TO ISRAEL.  
ALLAH IS GREAT.