



Physical Anthropology Section – 2005

H55 Marrying of Anthropology and DNA: Essential for Solving Complex Commingling Problems in Cases of Extreme Fragmentation

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The goal of this presentation is to describe how a combined effort of anthropologists and DNA scientists is essential to sorting out undetected commingling in cases of extreme fragmentation from mass disasters.

This presentation will impact the forensic community and/or humanity by providing useful tools to be used in large-scale identification efforts from mass disaster situations. This has been one of the largest identification efforts, and many lessons have been learned. It is important to disseminate this information for future use.

On September 11th 2001, American Airlines Flight 11 and United Airlines Flight 173 crashed into the twin World Trade Center towers and initiated a sequence of events that eventually felled both towers and five other commercial buildings, murdering 2749 individuals, of which 1565 have been identified to date. The rescue and the subsequent recovery lasted until May 2002, but the identification of the almost 20,000 fragments of human remains is on going with no end in sight. The World Trade Center work is the largest forensic identification effort in U.S. history and the problems have been magnified by the extreme fragmentation and commingling of the human remains.

Massive fragmentation of the victims and extensive commingling of the bodies characterized the World Trade Center disaster. The commingling had several contributing factors: two airplane crashes causing multiple building collapses where people died together, long recovery time, extensive watering from fire management, decomposition, the recovery techniques requiring large mechanical equipment, and attempted reconstruction of remains at the site by untrained personnel.

The DNA scientists did not initially believe commingling was a problem as long as it could be identified and the appropriate pieces could be separated. However, the DNA scientists were not in a position to see when duplicate pieces, such as two right feet, had identical DNA profiles. This is a problem that can have many origins: poor sampling techniques during the autopsy, tissue commingling within the remains, DNA contamination in the laboratory, and simple transcription errors.

This made commingling one of the most confounding problems encountered during the identification process. Initially, this was thought to be easily identified when tissue and bone samples ostensibly from the same case were giving different DNA profiles in the laboratory. However, in one case, a requested review of the remains uncovered the top and bottom portions of a torso did not actually articulate with each other indicating possibly two different individuals. The imminent release of the torso identified by DNA, to a single family, created concern about the accuracy of the identification. DNA typing of only one of the torso pieces tested identified the appropriate family. The other torso fragment, however, did not have a DNA test. Subsequent DNA testing after re-sampling confirmed the anthropologist's suspicions. This case initiated a new protocol where a 'final anthropological review' of all remains was necessary before the confirmation of every identification and subsequent release to the families.

After any identification is made, regardless of the scientific modality, an anthropologist does a visual inspection of the remains to confirm the level of detail recorded in its file as well as its congruity to the previously identified fragments of that individual. Often times, many fragments have been identified to one person. To date, the most fragments identified to one person are 209. Information such as the sex and age of the identified victim is considered, as well as a detailed review of all of the other fragments previously identified to that victim. Because the identification efforts have lasted so long, multiple fragments of remains have been identified to a single person years apart. These previously identified remains often have already been released to funeral homes. It has been through this final review process, that the majority of commingling and contamination mistakes have been identified and corrected. This paper will describe in detail how this task was accomplished.

Marrying both sciences, the authors discovered that the synergy of the two disciplines was necessary to ensure that commingling was found. Using World Trade Center examples of each of the different mechanisms of commingling, this paper will demonstrate how to identify that a problem exists and trace back to its root and from this information, solve the problem and put procedures in place so they can be recognized or avoided in the future.

Commingling, Identification, Mass Disaster