



A134 Resolving Extremely Commingled Skeletal Remains From the Sinking of the *USS Oklahoma* at Pearl Harbor on 7 December 1941 Through Mitochondrial DNA (mtDNA) Testing

Jennifer E. O'Callaghan, MFS, and Christopher W. Los, MSFS, Armed Forces DNA Identification Laboratory, 1413 Research Boulevard, Building 101, 2nd Floor, Rockville, MD 20850; Lauren M. Stagnitto, MFS, AFDIL, 1413 Research Boulevard, Rockville, MD 20850; Alexander F. Christensen, PhD, JPAC-CIL, 310 Worcester Avenue, Hickam AFB, HI 96853; and Suzanne M. Barritt, MS, Louis N. Finelli, MD, and Suni M. Edson, MS, Armed Forces DNA Identification Lab, 1413 Research Boulevard, Building 101, Rockville, MD 20850;*

After attending this presentation, attendees will learn of different DNA methods being employed in the resolution of the highly commingled remains from the sinking of the *USS Oklahoma*.

The presentation will impact the forensic science community by presenting a discussion of current status of the *USS Oklahoma* identifications, a look at instances of bone-leaching occurring between skeletal elements, the potential application of improved DNA typing methods (i.e., LCN STR, YSTR, XSTR), and a glimpse into several future directions for this case as it represents only one casket among approximately 65 containing those service members unaccounted for from the *USS Oklahoma*.

One of the primary missions of the Armed Forces DNA Identification Laboratory (AFDIL) is to aid the Joint POW/MIA Accounting Command – Central Identification Laboratory (JPAC-CIL) in the identification of missing service members from past U.S. military conflicts, including World War II, the Korean War, and the conflict in Southeast Asia. While it is common for JPAC-CIL to encounter commingled remains recovered from the field, a recent investigation of skeletal remains believed to have originated from the battleship *USS Oklahoma* has proven particularly difficult to identify due to the circumstances surrounding their burial.

On December 7, 1941, the United States was preemptively struck in Pearl Harbor, HI, by Japanese forces, effectively drawing the U.S. into WWII. The *USS Oklahoma* (BB-37) was one of eight battleships anchored in the area of Pearl Harbor known as "Battleship Row." Due to damage sustained from torpedoes during the attack, she capsized quickly. Several sets of remains were recovered in the following days; the remains of the rest of the crew were recovered during salvage operations spanning the next two years. A total of 429 Sailors and Marines were lost aboard the *USS Oklahoma*, including one pair of twins and one set of three brothers; 35 of these casualties were resolved historically.

In 1947, all "Unknown" individuals associated with the *USS Oklahoma* were disinterred and sent to the Central Identification Laboratory (CIL) at Schofield Barracks to be processed for potential identification. The identifications could not be made easily due to commingling, and the remains were recommended for group burial. Concurrently, changes in the definition of group burials resulted in this proposal being denied. Unfortunately, the damage was already done. The skeletons had been segregated into caskets of similar skeletal elements (i.e., one filled with skulls, another with femora, another with pelvic bones) in order to reduce the total number of required caskets. Orders to re-segregate the remains into individual skeletons failed and they were reinterred simply as unknown U.S. service members at the National Memorial Cemetery of the Pacific in Hawaii.

In 2003, the Central Identification Laboratory – Hawaii (CILHI) received information that indicated a particular casket among those from the *USS Oklahoma* should contain the remains of five individuals. The unusual treatment and segregation of the remains during the 1947 exhumation had been lost to the historical archives, and as a result, potential problems with these sets of remains were not apparent at the time. The casket was disinterred and initial anthropological assessments of the remains suggested extensive commingling.

Over the last five years, AFDIL has processed a total of 177 skeletal elements from this single disinterred casket. Sequencing has resulted, at the present time, in 95 unique mitochondrial DNA haplotypes, confirming suspicions of a worst-case-scenario in regards to the state of commingling. If one assumes all individuals currently unaccounted for from the *USS Oklahoma* to have a unique mtDNA haplotype, at a minimum, 22.7% of those service members can be attributed to skeletal remains within this assemblage. As this assumption does not take into account common mtDNA haplogroups shared among maternal lineages, nor the known instances of twins/siblings on board the battleship, the situation becomes much more complex. A lack of appropriate references also provides a hindrance. Currently samples have been collected from 53 of over 400 families which could be represented, which has allowed only three skulls to be identified to date. Included in this presentation will be a discussion of this unique case's current status, a look at instances of bone-leaching occurring between skeletal elements, the potential application of improved DNA typing methods (i.e., LCN STR, YSTR, XSTR), and a glimpse into several future directions for this case as it represents only one casket among approximately 65 containing those service members unaccounted for from the *USS Oklahoma*.

The views expressed herein are those of the authors and not The Armed Forces Institute of Pathology,



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