

Expert Forensic Voices

Identifying Missing Soldiers: DNA Analysis in Asia

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Images representing MIA soldiers in South Korea. Photo: Jinhee Lee

More than six decades after the conflicts in Korea and Vietnam, historic political shifts result in a rise in ancient DNA (aDNA) collection and the need for sophisticated forensic labs to meet the needs for today's aDNA processing techniques.

Jinhee Lee's personal perspective

This subject of recovering and putting closure to 60 years of unknowing is near to my heart since one of my family members has yet to be recovered from the Korean War. My grandfather's brother, a Korean soldier assigned to the U.S. 2nd Infantry Division, was last reported to be in a battle near Changbong-ni, a city in modern day North Korea. Along with so many other soldiers of that era, he was labeled MIAPD (Missing in Action and Presumed Dead). After the Korean War's ceasefire, my grandfather made it a tradition to visit the Demilitarized Zone at the 38th Parallel on Korean War Memorial Day to pay his respects.

This is not a unique story as many other families from both wars are still seeking closure on the story of their relatives and friends lost in the fighting. It is my hope that many of these remains may be identified in the future through improvements in DNA analysis and the remains will be returned to their families. Perhaps, during my father's lifetime, we will bring closure to the unknown.

The searches

More than 18,000 American, South Korean and Vietnamese soldiers have been designated Missing in Action (MIA). For several decades afterward, North Korean and Vietnamese governments had neither the resources nor the political will to share the human remains that still lay on their lands.

Eventually, the U.S. Department of Defense (DoD) POW/MIA recovered human remains from both the Korean and Vietnam Wars.

In early 1990, the U.S. government requested North Korea send the remains of the bodies that still resided there. As a result, the government of North Korea delivered 208 boxes of unidentified human remains to the United States and South Korea.

In 2011, U.S. recovery teams made a series of trips to North Korea in search of more remains. This collection effort expanded to having research teams search for bodies on Vietnamese and North Korean soil.

They accessed make-shift burial sites where they recovered more bodies. They conducted tests that revealed many of the remains belonged to the same bodies that were originally delivered by North Korea decades earlier.

According to Time Magazine, "the Vietnamese government has been relaxing access to archives that contain information about killed or missing U.S. troops—part of a wider expansion of its military ties with the U.S. to maintain a regional balance of power against China."

The Vietnamese government collaborated with American researchers on a program to help recover the remains of bodies through the discovery and testing of aDNA or any unidentified human DNA.

As a result of the effort, researchers recovered and identified more than 1,300 American, Korean and Vietnamese remains.

The American MIA researchers, who are involved in both Korean and Vietnam projects, have had a major impact on enhancing the forensic capabilities of the host countries by requiring upgrades to their lab systems, raising lab standards and improving training techniques.

aDNA Identification

DNA analysis is the key to the unknown; aDNA resolves forensic mysteries from prehistoric populations.

What changed historically to make aDNA collection and identification relevant today?

- Process times have shortened with the use of robotics and computer software, minimizing the interface time of the operator and reducing user error.
- Researchers have been successful at identifying human remains using mitochondrial DNA, which are passed from mother to child through the organelles in cells.
- There are alternative methods to find DNA sources including, but not limited to, dental records and chest X-rays.

Despite six decades of bone degradation, researchers have been

able to extract nuclear profiles and match those useable samples with those from their families.

Facility design

With years of experience leading up to this point, researchers had a good idea of the components required for aDNA facilities to meet their goals.

What makes an aDNA identification lab unique from other DNA identification labs?

- DNA processing is accomplished in a linear flow of exam, extraction, prep, amplification vs. aDNA, which requires three separated pre-PCR (cleanrooms) in addition to PCR and post-PCR rooms. This is done to prevent cross contamination in aDNA.
- aDNA: Pre-PCR rooms and individual workstations have dedicated individual HEPA filtered with UV lights for sterilization. The positive pressure airflow eliminates any contaminants.
- aDNA: Specimen are carefully brought in and out of the working area, including the use of pass through boxes. This minimizes cross contamination within the facility.

Overall, in the past five years, the aDNA process has evolved rapidly since the very early stages of MIA mission.

In 2011, K208 Lab in Hawaii was established within an existing remains lab after receiving 208 boxes for unidentified mixed remains from North Korea from the Korean War.

It took the lab almost 10 years to crack the cases. Due to DNA technology evolution using mitochondrial DNA, approximately 600 bodies were identified and their remains have been returned home to their families.

In 1988, U.S. teams were granted a search throughout Vietnam, along with the South Asian countries, Laos and Cambodia, to research in the discovery of crash and burial sites across the region.

The search operations expanded when U.S. Defense POW/MIA established larger field searches in 1992 and a laboratory in Vietnam to identify the remains.

Vietnamese and U.S. Defense POW/MIA forensic personnel received a 5-year grant to further study the ongoing research to identify the remains of missing servicemen.

As a result, Project 150 Lab was generated, and three major agencies in Vietnam are still working on this project today.

The Department of Justice's International Criminal Investigative Training Assistance Program (ICITAP) sought to provide Vietnam with a state-of-the-art laboratory facility. ICITAP contracted with Crime Lab Design (CLD) to lead the facility evaluation and recommendations. Last year, CLD was invited to prepare a study on an aDNA facility in Vietnam. Based on worldwide laboratory design experience, CLD made recommendations on how the facility could meet current standards and anticipate future research needs. The architectural firm suggested rearranging proposed floor plans to provide a smooth flow, prevent cross contamination and reach the capacity of sample testing envisioned for the lab. The firm also recommended a reconfiguration of laboratory equipment.

As DNA technology and analysis continues to improve, it is the authors' hopes that more soldiers' remains can be identified and returned to their families. International cooperation and well designed and constructed forensic DNA and aDNA facilities are required for this to happen.

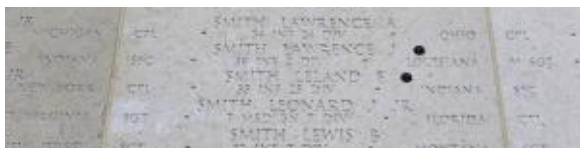
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