

CASE REPORT

CRIMINALISTICS; ANTHROPOLOGY

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Integrated DNA and Fingerprint Analyses in the Identification of 60-Year-Old Mummified Human Remains Discovered in an Alaskan Glacier

ABSTRACT: This report describes the identification of a merchant mariner who perished in 1948 when Northwest Airlines Flight 4422, a DC-4 carrying 24 seamen and six crew members crashed into Mount Sanford, Alaska. Fifty-one years later, a human forearm and hand were found close by the wreckage of the plane, prompting identification efforts using DNA and fingerprints. There were significant challenges to both the fingerprint and DNA analyses. The hand was badly desiccated, making fingerprint friction-edge detail almost invisible and the remains had been embalmed upon discovery, making DNA amplification difficult. We present the results of an interdisciplinary approach that successfully addressed these challenges and ultimately led to the identification of the remains. These efforts relied on efficient fingerprint rejuvenation and imaging techniques that improved print resolution, as well as new DNA extraction techniques optimized for aggressively embalmed remains.

KEYWORDS: forensic science, fingerprint analysis, low copy number STR, mitochondrial DNA, ancient DNA, embalming, interdisciplinary, forensic genealogy, merchant mariners

At 9:14 P.M. on March 12, 1948, Northwest Airlines Charter Flight 4422, en route from Shanghai to New York City, crashed in the Wrangell Mountains of Alaska. The Douglas DC-4 was carrying six crew members and 24 seamen returning home after a mission on the oil tanker *SS Sarsvet* of the Overseas Tankship Corp. After a fuel stop, the plane took off from Anchorage, Alaska at 8:12 P.M. At 9:03 P.M., the plane was spotted flying at 11,000 feet above the Gulkana Civil Aeronautics Administration range station, 159 miles northeast of Anchorage. Eleven minutes later, the plane impacted Mount Sanford, a 16,237-foot peak located 200 miles northeast of Anchorage. The next day, aeronautic officials flew over the crash site. From the air, they observed the wreckage lying at an elevation of 8500 feet on the west slope of the mountain, below a section of smoke-blackened snow and ice at 11,000 feet that likely corresponded to the point of impact. A rescue operation

was ruled impossible because the scene of the accident was inaccessible by air. No ground search was initiated as it was determined that the active glacier would bury the wreckage in a matter of days. However, a positive identification of the wreckage as that of Flight 4422 was made by the Northwest Airlines insignia on the plane's vertical tailfin observed from the air.

Fifty-one years later, the wreckage was rediscovered by Kevin McGregor and Marc Millican, two former United States Air Force pilots. In 1997, after three unsuccessful expeditions, the two men finally located pieces of the plane, including a radial engine and a propeller at an altitude of 6200 feet. Two years later, they returned to the site and discovered a frozen human left forearm and hand amid the wreckage (1,2).

Alaskan State Troopers recovered the remains and delivered them to the Office of the Medical Examiner in Anchorage, Alaska. X-rays of the arm showed extensive damage to the bones (Fig. 1). Fingerprint images were also taken of the hand and were compared to the fingerprints of 22 of the 24 merchant mariners. The mariners' fingerprints had been collected at the time of their enlistment and archived at the National Maritime Center in Arlington, VA. Unfortunately, in 1999 no match was obtained, most likely because of the difficulty of resolving details from the fingerprints of the damaged remains in combination with the poor quality of the enlistee fingerprint cards. Following these examinations, the remains were aggressively embalmed by submersion for 5 days in a solution composed of Metasyn Normal (20 index), Metalflex, Restorative (Dodge Chemical Company, Cambridge, MA), and water (Fig. 2).

The effort to identify the flight 4422 remains was first revived in 2002 when the hand and forearm were sent to a commercial

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Received 23 Oct. 2008; and in revised form 15 May 2009; accepted 17 May 2009.

Using Dna To Identify Human Remains Answers

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Table of Contents Using Dna To Identify Human Remains Answers

1. Understanding the eBook Using Dna To Identify Human Remains Answers
 - The Rise of Digital Reading Using Dna To Identify Human Remains Answers
 - Advantages of eBooks Over Traditional Books
2. Identifying Using Dna To Identify Human Remains Answers
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Using Dna To Identify Human Remains Answers
 - User-Friendly Interface
4. Exploring eBook Recommendations from Using Dna To Identify Human Remains Answers
 - Personalized Recommendations
 - Using Dna To Identify Human Remains Answers User Reviews and Ratings
 - Using Dna To Identify Human Remains Answers and Bestseller Lists
5. Accessing Using Dna To Identify Human Remains Answers Free and Paid eBooks
 - Using Dna To Identify Human Remains Answers Public Domain eBooks
 - Using Dna To Identify Human Remains Answers eBook Subscription Services
 - Using Dna To Identify Human Remains Answers Budget-Friendly Options

6. Navigating Using Dna To Identify Human Remains Answers eBook Formats
 - ePub, PDF, MOBI, and More
 - Using Dna To Identify Human Remains Answers Compatibility with Devices
 - Using Dna To Identify Human Remains Answers Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Using Dna To Identify Human Remains Answers
 - Highlighting and Note-Taking Using Dna To Identify Human Remains Answers
 - Interactive Elements Using Dna To Identify Human Remains Answers
8. Staying Engaged with Using Dna To Identify Human Remains Answers
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Using Dna To Identify Human Remains Answers
9. Balancing eBooks and Physical Books Using Dna To Identify Human Remains Answers
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Using Dna To Identify Human Remains Answers
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Using Dna To Identify Human Remains Answers
 - Setting Reading Goals Using Dna To Identify Human Remains Answers
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Using Dna To Identify Human Remains Answers
 - Fact-Checking eBook Content of Using Dna To Identify Human Remains Answers
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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