# Bibliography details

**Name of the Serial/Publication**: Veritas

**Volume No.:** 1

**Issue No.:** 1

**Month & Year of publication:** August 2021

**Page numbers:** Global News Updates (23-26)

**Title of Article:** Stable Isotopes of Water help in location identification

**Contributor (s)**

1. Ms. Nivya George

# STABLE ISOTOPES OF WATER HELP IN LOCATION IDENTIFICATION

Ms. Nivya George

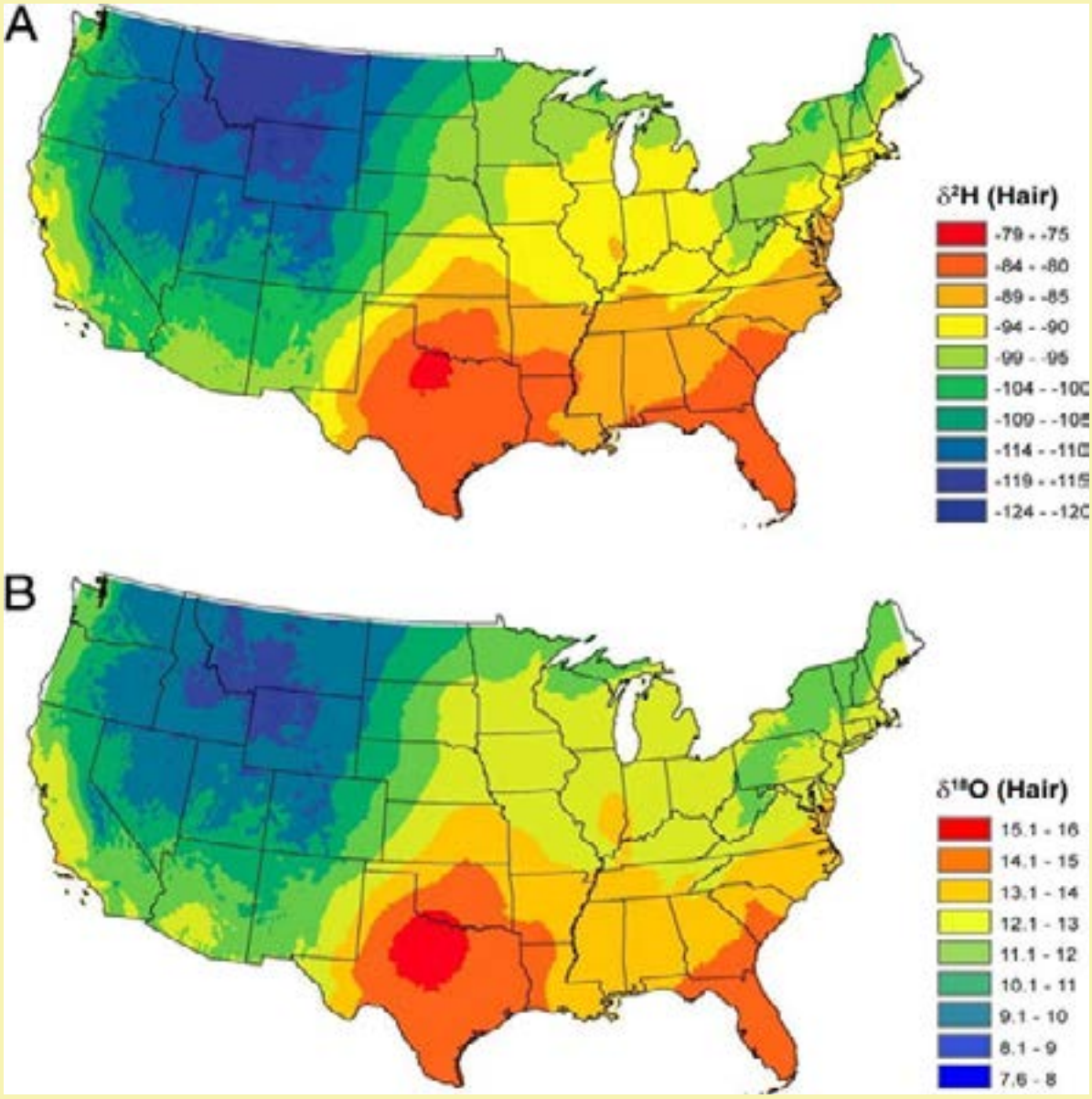
Isotopes are atoms of the same element having a different number of neutrons and differ in atomic mass with the same chemical properties. Isotopes are present everywhere in the world in a different ratio, making them forensically significant. $^{2}H/H$, $^{18}O/^{16}O$, $^{13}C/^{12}C$ are the common stable isotopes. Hydrogen: protium, deuterium, tritium, and Oxygen: $^{18}O$,$^{16}O$,$^{17}O$ are the stable isotopes of water. The ratio of stable isotopes of water differs from the coastal region to inland.

The heavier isotopes are seen in the coastal area while they become lighter and lighter, moving towards the inland. The reason for this difference is when it rains, the higher molecules like $D_2O$ ($^{18}O$ and deuterium) fall first near the coastal region, and when it moves inland, the $D_2O$ molecule gets lower, and the $H_2O$ molecule starts to fall more.

The analysis of water-stable isotopes in the body helps to find the location of each species. The body likes to build up with the help of water molecules of different isotopes i.e., hydrogen and oxygen. The species near the sea contain heavier isotopes while species in the forest have lighter ones. The ratio between heavier and lighter molecules of water isotopes helps to find the movement of a species from different geolocation on earth. For example, if a species lives in hills for more than 10 years and comes to a coastal region and lives for 5 months, the examination of the ratio of water isotopes shows lighter molecules of oxygen $^{16}O$ than heavier oxygen $^{18}O$ in the body. The analysis of water isotopes can also provide more information about the location, habit, living conditions, etc.

The hair and nail of a species are more likely to be taken for the analysis of water isotopes. Hair and nail leave an isotope timeline that remains unchanged. Oxygen isotopes are incorporated into all other parts of the body than hair and nail. If a person continues to travel from place to place

and drinks water, the ratio of the water isotopes in the body differs in each fragment of the hair and nail.




SIRMS is the new technique used for the analysis of the relative abundance of isotopes. Stable Isotope Ratio Mass Spectroscopy technology is able to find the relative isotopes concerning their geographical condition. The comparison of the ratio of stable isotopes in water from different regions gives different peaks in SIRMS. This can be compared with the ratio of the stable isotopes in a species body to find the location of those species.

In a case like drowning, a homicidal drowning, or a corpse thrown to any water body to mislead the case, the primary and secondary crime scene can be found by water isotopes analysis when the corpus is badly decomposed and any other identification details of the victim cannot be found. In October 2000, some duck hunters in Utah, near the south of Great Salt Lake, found a half-buried in a shallow grave, a plastic bag with white socks, an oversized t-shirt, a women blue choker necklace, 12 bones, and a human skull. The victim was named 'Saltair Sally' by the police. There were no clues to find the victim as well as the suspect. The body was badly decomposed, and the dental record didn't reveal anything. The case went cold for 8 years until a new technique in Forensic Science arrived. The scientists used Stable Isotope Ratio Mass Spectroscopy (SIRMS) for analysis of the hair fragments of Saltair sally, which revealed the person to be from the Pacific Northwest region. Varying $^{18}O/^{16}O$ ratio of the victim's hair fragment showed that the person travelled from Pacific Northwest to Utah reveal times during her last time. Comparison of $^{18}O/^{16}O$ ratio of water in Utah and northwest pacific region showed, somewhere consistent in Utah environment others were from the Pacific Northwest region. On August 7, 2012, the police found the victim to be Nikole Bakoles, a Washington native, who moved to Utah in 1998. A DNA test confirmed the victim.

The isotopes are used to solve cases from decades back, but the application of analysis of the ratio of water isotopes needs to emerge in the field.

## References


- Bartelink, E. J., & Chesson, L. A. (2019). Recent applications of isotope analysis to forensic anthropology. Forensic sciences research, 4(1), 29-44 https://doi.org/10.1080/20961790.2018.1549527


Myth - Anyone in the crime scene can collect evidence and anyone can take it to the laboratory.

Fact - Every person who comes in contact with the evidence, from the time of collection till the time of analysis should write down their personal identification information and the reason for handling the evidence in a form called Chain of Custody which is usually attached along with the packaged evidence.