

Ancient ritual bundle contained multiple psychotropic plants

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The team found psychoactive compounds in an animal-skin pouch constructed of three fox snouts stitched together. Credit: Jose Capriles, Penn State

A thousand years ago, Native Americans in South America used multiple psychotropic plants—possibly simultaneously—to induce hallucinations and altered consciousness, according to an international team of anthropologists.

"We already knew that psychotropics were important in the spiritual and religious activities of the societies of the south-central Andes, but we did not know that these people were using so many different [compounds](#) and possibly combining them together," said Jose Capriles, assistant professor of anthropology, Penn State. "This is the largest number of psychoactive substances ever found in a single archaeological assemblage from South America."

The researchers were searching for ancient occupations in the dry rock shelters of the now-dry Sora River valley in southwestern Bolivia when they found a ritual bundle as part of a human burial. The bundle—bound in a leather bag—contained, among other things, two snuffing tablets (used to pulverize psychotropic plants into snuff), a snuffing tube (for smoking hallucinogenic plants), and a pouch constructed of three fox snouts.

The team used accelerator mass spectrometry radiocarbon dating to determine the age of the outer leather bag and found that it was about 1,000 years old.

"This period in this location is associated with the disintegration of the Tiwanaku state and the emergence of regional polities," said Capriles.



The researchers found a ritual bundle in the Cueva del Chileno rock shelter located in southwestern Bolivia. Credit: Jose Capriles, Penn State

In addition, the team used a scalpel to obtain a tiny scraping from the interior of the fox-snout pouch and analyzed the material using liquid chromatography with tandem mass spectrometry.

"This method is highly sensitive and very effective for detecting the presence of minute amounts of specific compounds from very small samples," said Melanie Miller, postdoctoral fellow at the University of Otago, New Zealand, and research affiliate at the University of California, Berkeley, who was responsible for analyzing the samples.

The researchers identified the presence of multiple psychoactive

compounds—cocaine, benzoylecgonine (the primary metabolite of cocaine), harmine, bufotenin, dimethyltryptamine (DMT) and possibly psilocin (a compound found in some mushrooms)—from at least three different plant species (likely *Erythroxylum coca*, a species of *Anadenanthera* and *Banisteriopsis caeni*). The results will appear during the week of May 6 in *Proceedings of the National Academy of Sciences*.

According to Capriles, the fox-snout pouch likely belonged to a shaman.

"Shamans were ritual specialists who had knowledge of plants and how to use them as mechanisms to engage with supernatural beings, including venerated ancestors who were thought to exist in other realms," said Capriles. "It is possible that the shaman who owned this pouch consumed multiple different plants simultaneously to produce different effects or extend his or her hallucinations."



The ritual bundle included two carved and decorated wooden snuffing tablets that would have been used as a platform on which to pulverize psychotropic plants. Credit: Jose Capriles, Penn State

Capriles noted that the co-occurrence of harmine and DMT, which are the primary ingredients of ayahuasca—a beverage that is reported to induce hallucinations and altered consciousness—in the pouch suggests the use of this beverage as one of the drugs in the shaman's kit.

"Some scholars believe that ayahuasca has relatively recent origins, while others argue that it may have been used for centuries, or even millennia," said Capriles. "Given the presence of harmine and DMT together in the pouch we found, it is likely that this shaman ingested these simultaneously to achieve a hallucinogenic state, either through a beverage, such as ayahuasca, or through a composite snuff that contained these plants in a single mixture. This finding suggests that ayahuasca may have been used up to 1,000 years ago."

Not only does the presence of numerous compounds suggest simultaneous use of drugs and earlier use of ayahuasca, in particular, but it also indicates intricate botanical knowledge by the owner of the pouch and an effort to acquire hallucinogenic plants, as the plants came from different regions of mostly tropical South America.

"The presence of these compounds indicates the owner of this kit had access to at least three plants with psychoactive compounds, but potentially even four or five," said Miller. "None of the psychoactive compounds we found come from plants that grow in this area of the Andes, indicating either the presence of elaborate exchange networks or the movement of this individual across diverse environments to procure

these special plants. This discovery reminds us that people in the past had extensive knowledge of these powerful [plants](#) and their potential uses, and they sought them out for their medicinal and psychoactive properties."

More information: Melanie J. Miller et al., "Chemical evidence for the use of multiple psychotropic plants in a 1,000-year-old ritual bundle from South America," *PNAS* (2019).

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