thermo scientific

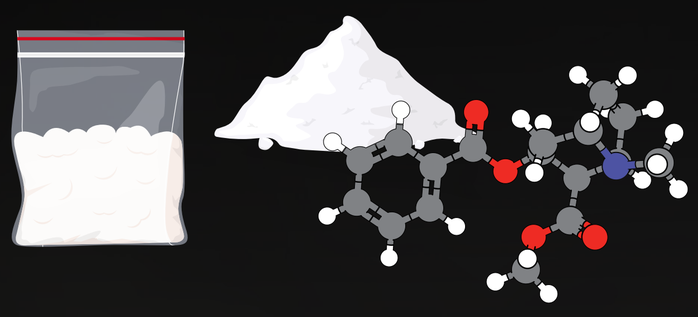
Where's the Cocaine Coming From?

Isotope fingerprints and what they tell us about geographical origin of cocaine

History can't hide from the Isotope Hunter. Geography, geology and growth conditions of foods, fibers, liquids or stone are embedded in their unique isotope fingerprints. Trace your sample history with the Thermo Scientific™ Isotope Ratio Mass Spectrometry portfolio.

Coca leaves and cocaine samples

Isotope fingerprints can help trace cocaine production regions through analysis of coca leaves and cocaine samples.



Why examine cocaine?

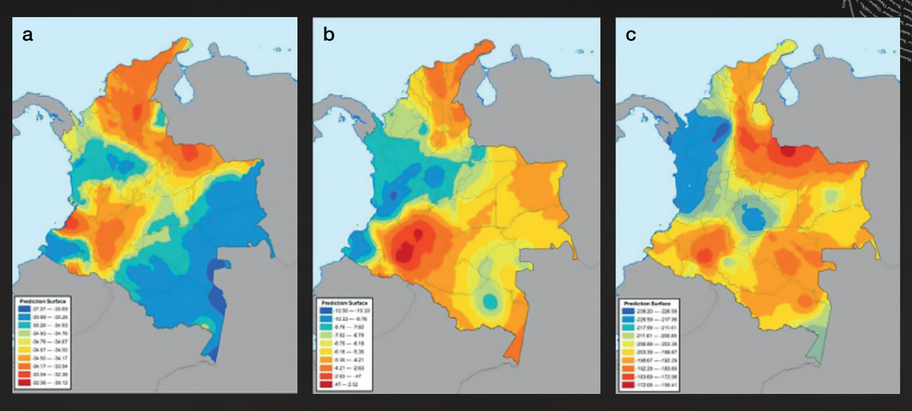
Cocaine is one of the world's most widely used narcotics and this widespread use and abuse has resulted in more investigations aimed at tracing the coca cultivation regions and identifying exportation routes of the illicitly isolated cocaine. Tracing the origin of cocaine has previously been achieved at the regional scale, however, as a result of a significant expansion of coca cultivation and movement for processing and distribution, the identification of cocaine origin at the sub-regional scale has become increasingly difficult. Despite the complexities evident, it has been shown that isotope fingerprints in seized cocaine provide an enhanced insight that allows the coca cultivation region to be identified when combined with trace alkaloids.

Isotope fingerprints of coca plants and cocaine

The carbon and nitrogen isotope fingerprints ($\delta^{13}C$ and $\delta^{15}N$ values) in coca plants follow the predicted pattern as they relate to environmental factors. The hydrogen and oxygen isotope fingerprints ($\delta^{2}H$ and $\delta^{18}O$ values) of seized cocaine can be utilized to help trace geographical origin.

Tracing the origin of seized cocaine: a journey from South America to USA

Mallete et al (2016) collected 572 coca leaf samples from 19 known growing regions throughout Bolivia (*n* = 58), Colombia (*n* = 361), and Peru (*n* = 153). These samples served as a true reference point to compare the seized cocaine with. The Figure below shows isoscapes for carbon (Figure a), nitrogen (Figure b) and hydrogen (Figure c) isotope fingerprints of coca leaves across Colombia, which were used to identify and understand general differences observed with the direct analysis of cocaine samples.



Example of cocaine isoscapes from Colombia showing carbon (a), nitrogen (b) and hydrogen (c) isotope fingerprints.

Geographic identification

The origin classification of cocaine to one of 19 known coca-growing regions in Colombia, Peru, or Bolivia is now possible. In addition, comparing unknown cocaine samples to a database of authentic geographically referenced cocaine samples and utilizing the framework described by Mallete et al (2016) allows for the discovery of new coca growing regions within South America. This was best exemplified by identifying Beni, Bolivia as a coca growing region previously unknown to the enforcement and law authorities.

This study has shown the powerful contribution that isotope fingerprints of coca leaves and cocaine make to identifying the origin of seized cocaine. Moreover, these data are based on bulk measurements of carbon, nitrogen, hydrogen and oxygen using Elemental Analysis Isotope Ratio Mass Spectrometry.

Mallete, J.R., Casale, J.F., Jordan, J., Morello, D.R., Beyer, P.M. (2016). Sci. Rep. 6: 23520.

Detecting ^{13}Clues, tracking ^{18}Origin, unraveling ^{2}History with isotope fingerprints

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