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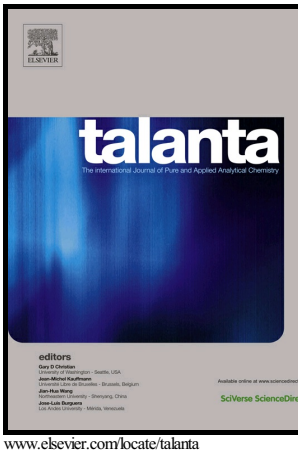

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ACCEPTED MANUSCRIPT

Lead isotope ratios for bullets, forensic evaluation in a Bayesian paradigm

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Abstract

Forensic science is a discipline concerned with collection, examination and evaluation of physical evidence related to criminal cases. The results from the activities of the forensic scientist may ultimately be presented to the court in such a way that the triers of fact understand the implications of the data. Forensic science has been, and still is, driven by development of new technology, and in the last two decades evaluation of evidence based on logical reasoning and Bayesian statistic has reached some level of general acceptance within the forensic community.

Tracing of lead fragments of unknown origin to a given source of ammunition is a task that might be of interest for the Court. Use of data from lead isotope ratios analysis interpreted within a Bayesian framework has shown to be suitable method to guide the Court to draw their conclusion for such task.

In this work we have used isotopic composition of lead from small arms projectiles (cal. .22) and developed an approach based on Bayesian statistics and likelihood ratio calculation. The likelihood ratio is a single quantity that provides a measure of the value of evidence that can be used in the deliberation of the court.

Keywords: Bullets, ammunition, lead isotope ratios, lead isotopic composition (LIC), multicollector inductive coupled plasma mass spectrometry (MC-ICP-MS), forensic evaluation, interpretation, likelihood ratio, LR, Bayesian statistics, descriptive statistics.

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1. Introduction

Interpretation and statistical evaluation of evidence for the forensic sciences has been subject to intense scrutiny and attention in the last two decades [1], [2]. The acceptance of probabilistic approach to evidence avaluation are growing in

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