BRAZIL AS A MAIN ROUTE FOR INTERNATIONAL NARCOTICS TRAFFICKING: EXPLORING SOIL EVIDENCES FOUND IN SEIZED LOADS AT THE PORT OF PARANAGUÁ

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ABSTRACT: Brazil plays a major role regarding the distribution of coca-based drugs to European markets, especially due to its wide and difficult to monitor north and western border, which is very close to the Andean producers. Once the cargo drives its way into the Brazilian ports, most of it are shipped sneaked through West and South Africa, as a minor part is shipped directly to Iberian Peninsula. When a load is seized by authorities, some information about its journey can be obtained by investigating trace evidence found both on the package and the drug itself. Soil, commonly found adhered or wrapped around the slabs, can be used either to compare different seizures, or to provide geographic data about smuggling routes and clandestine labs – however, until now, little to no efforts in Brazil have been done to deeply evaluate this subject using a geological approach. In this research, we aim to contribute to law enforcement agencies by taking the first steps on stablishing protocols to build a database on soil evidence collected from cocaine seizures. Five different apprehensions were selected, all of them related to drugs found inside containers in the Port of Paranaguá in a 12-month interval, ready to leave the continent. The soil traces from the slabs were sampled and submitted to non-destructive analysis, such as color measurement, stereo microscopy, magnetic susceptibility, gamma ray spectroscopy, x-ray diffratometry (XRD), Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy with energy dispersive x-ray spectroscopy (SEM-EDS). Furthermore, the results were then statistically evaluated through discriminant and principal component analysis. Using the cited methods, it was possible to obtain both quantitative and qualitative data, allowing to identify the mineral and elemental contents, functional groups, grain texture and morphology, radiometric and magnetic signatures, and CIE L*a*b coordinates - overall, at least 50 variables were gathered. In this way, we found that geochemical composition and color coordinates represents the best discriminant attributes in the array, as the first component explain 76% of total variance. Due to the small sample size, it was not possible to cluster any data, even though a clear distinction between them is visible. XRD results showed that, despite of the abundance of quartz and clay minerals on the assemblage, minor mineral species holds an important position in the distinctiveness of the population, such as apatite, titanite and magnetite. In addition, quartz grain surface texture analysis through SEM also stand out as a unique fingerprint for sample comparison. Therefore, these features can be the key to link or not different seizures. Since there is no prior forensic soil database, it is still not possible to geolocate the smuggling routes, however, the gathered information allows us to infer that the soil traces found on the cocaine slabs comes from distinct sources – it could mean different vehicles, labs, or spots used for loading the cargo. This protocol, if associated with drug chemical profiling, would provide much greater intelligence information. The goal, now, is to keep feeding the database by sampling further seizures.

KEYWORDS: FORENSIC SOIL SCIENCE, TRACE EVIDENCE, DRUG TRAFFICKING