Paper Number: 5227

Tracing illicit gold from South America

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Much of the extensive gold mining that takes place across the northern part of South America is by artisanal miners, who may or may not be working legally, depending on the laws of the particular country. In some countries, the loss of revenue due to illicit mining has been estimated to be in excess of 50% of the total gold extracted. Combatting this illicit trade is a priority for many countries. The gold deposits range in age from Archaean to recent, and are mainly hosted in greenstones or ultramafic rocks on the Guyana Shield. Most of the northern part of South America is covered with lateritic soils that are often enriched in gold where they occur above primary gold mineralisation. The majority of the illicit artisanal mining operations utilise mercury amalgamation to recover gold, as opposed to the commercial carbon in pulp (CIP) methods used by most legal producers [1].

Gold bars seized in transit in the Caribbean were allegedly the product of illicit mining in Venezuela, although the shippers stated Colombia as the country of origin. Owing to problems of legality, politics and potential danger to the collectors of representative reference samples, it was only possible to obtain control samples of artisanal alluvial workings that had been recovered using mercury amalgamation from Colombia. It was not possible to obtain similar artisanally produced gold from Venezuela, and the only samples obtained were from legal mines utilising the CIP process.

In order to determine whether the illicit gold bars originated from the Chocó area in Colombia or Bolivar State in Venezuela it is necessary to extract, from the analytical data, the elemental signatures which can indicate the more likely point of origin. This type of evaluation has been done for the simple alluvial case, where the gold had not been processed after recovery [2]. However, the effects of processing by different means also has to be taken into consideration, as the processing method may add or remove specific elements to varying degrees.

The interpretation of initial elemental analysis of the seized bars and the control samples showed no clear discrimination between the various possible origins. However, after a thorough analysis of the genetic origins of the gold, the effect of the climate and topography on the deposits, as well as the beneficiation processes employed, it was possible to clearly exclude the putative origin. This demonstrates that for origin determination of processed gold the forensic geologist should understand not only the geology but the processing as well. Without this knowledge a database of samples from different deposits will not necessarily assist in the identification of origin of illicit gold.

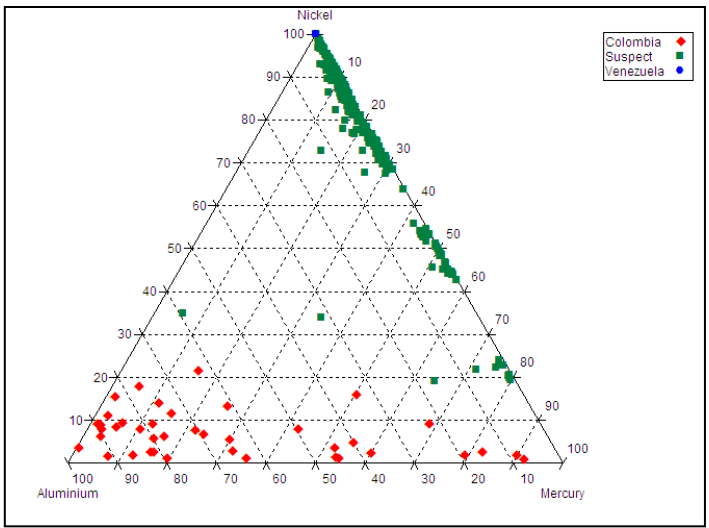

Figure 1: The gold produced by the CIP process from Venezuela sits at the Ni apex. The gold bars and the gold from Colombia show a spread of values due to the

relatively inconsistent artisanal process, as well as differences in material processed.

References:

[1] García-Sánchez A et al. (2006) Environ Geochem Health 28:529-540
[2] McInnes M et al. (2008) Appl Geochem 23:1076-1085