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Tracing the source of stolen PGM smelter products

Schouwstra, R.P.[1] and Dixon, R.D.[2]

[1]Independent Consultant: Mineralogy, Roodepoort; Adj. Prof. JKMRC, UQ; Affiliated Assoc. Prof. Geology Dept, UFS of Pretoria, South Africa
[2]University of Pretoria, South Africa, roger.dixon@up.ac.za

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The theft of platinum group metal bearing materials from smelters and refineries in country of origin is an ongoing problem world-wide, with stolen materials being refined in countries far from source and usually without local sources of raw materials. In order to stem the illicit trade in these stolen materials, fingerprinting of recovered mine and plant products has been implemented ([1], [2]), with the aim of returning recovered material to their legal owners, and enabling successful prosecution in court. In southern Africa, a large proportion of the materials at risk are converter mattes from the smelters. These are smuggled to the various refineries, mainly in Europe, and the onus is on the producer to prove origin. Material from different sources is often finely ground and mixed in an attempt to disguise the sources.

Although chemical data can be used to discriminate between deposits, these deposits are commonly exploited by a number of mining companies. A purely chemical fingerprinting technique is incapable of differentiating between mattes from operations in the same mining province, due to the variability in chemical element distribution within and between mining areas. Slight variations in the processes at different smelters, as well as the ore deposit mined, can result in only minor differences between the mattes from different smelters. A combination of physical properties (*e.g*. shape, size, density), chemistry and mineralogy is used to determine the fingerprint of the main producing areas, the specific product and the producer. The techniques used include X-ray diffraction and automated scanning electron microscopy, which are essential when material from different sources is mixed together, requiring a particle by particle examination. This approach has resulted in successful prosecutions, including action against refineries shown to have knowingly accepted stolen material from other countries.

In this paper we show how the methodology is applied, as well as providing guidelines to its successful implementation in combatting the cross-border illicit PGM trade.

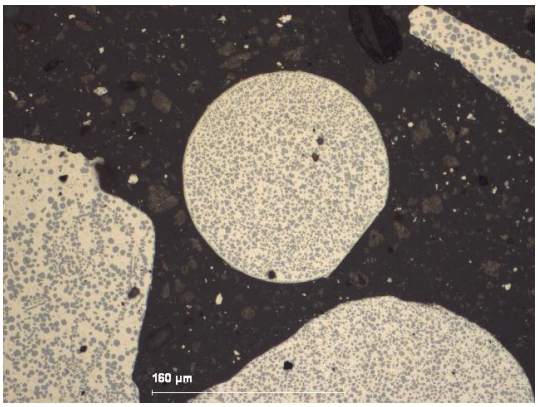

Figure 1 (left): A shipment of converter matte, packaged as potatoes, intercepted on the way out of South Africa en route to a refinery in Europe. Figure 2 (right): Polished section of matte from a South African platinum producer showing the typical texture of granulated converter matte (a distinguishing feature of some producers).

References:

[1] Perelygin A et al 2008 Forensic Sci Int. 174(1):12-15
[2] ENFSI 2008 CIP Project Report http://www.enfsi.eu/documents/cip-project-report