

Analysis of XX century gold-silver coins by X-ray fluorescence and neutron tomography

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X-ray fluorescence (XRF) is a technique capable of analyzing chemical elements on metallic surfaces, providing fast, sensitive, and reliable results while neutron tomography (NT) allows to investigate its internal structure by three-dimensional images. Both techniques are powerful tools for non-destructive analysis of artistic and historical objects. In this study, we explored the combined use of these techniques to investigate a set of Brazilian gold-silver coins dating from the early 20th century (1913-1938). This set of coins was selected due to the lack of data related to their composition and origin. These data provide information to museologists for better cataloging / registration of fundamental information. Moreover, this information is vital for collectors and *marchands* in authentication processes. The X-Ray Fluorescence analysis was performed using X-Ray Spectrometer with gold (Au) and silver (Ag) targets. The excitation conditions were optimized in 30 kV and 5 μ A and counting time of 200 s. A NT facility is installed at the beam-hole (BH-14) of the 4.5 MW pool-type IEA-R1 nuclear research reactor at IPEN (SP, Brazil). It consists of a ^6LiF (ZnS) scintillator screen, a glass-based plane mirror, a video camera (16bit, 1024 x 1024 pixels, cooled CCD) and a collimator to reduce the neutron beam size in the BH-14. The experimental conditions established were: $8 \times 10^6 \text{ ns}^{-1} \text{ cm}^{-2}$ (neutron flux), irradiation time/image of 1s, spatial resolution of $263 \pm 35 \mu$ and time tomography of 400s. The three-dimensional images were treated using dedicated software (OctopusV8.0 and VG studio Max2.2). The combined results bring information of elemental composition and 3D images highlight the conservation state of the pieces, being of great aid to conservators and museologists.