

ANALYTICAL STUDY OF MINERAL SPECIMEN

Sample Id.: JF2012010-1

Requested by: FMinerals.

Date: 3/12/2020

Description: Gold sample from Morocco (not specified the origin or deposit). Broad wires or filiform. In the observed samples, texture spongy or scoriaceous in one sample. Second sample formed by rough or rounded octahedra. Apparent iron oxides intergrown or covering the gold. Color and luster suggest possible silver content. In the observation under microscope, no evidence of non-natural growth or wires as nucleation inductors. Analyzed samples are a 2 cm broad wire of spongy texture weighing 0.176 g and 0.138 g, roughly crystalline sample.





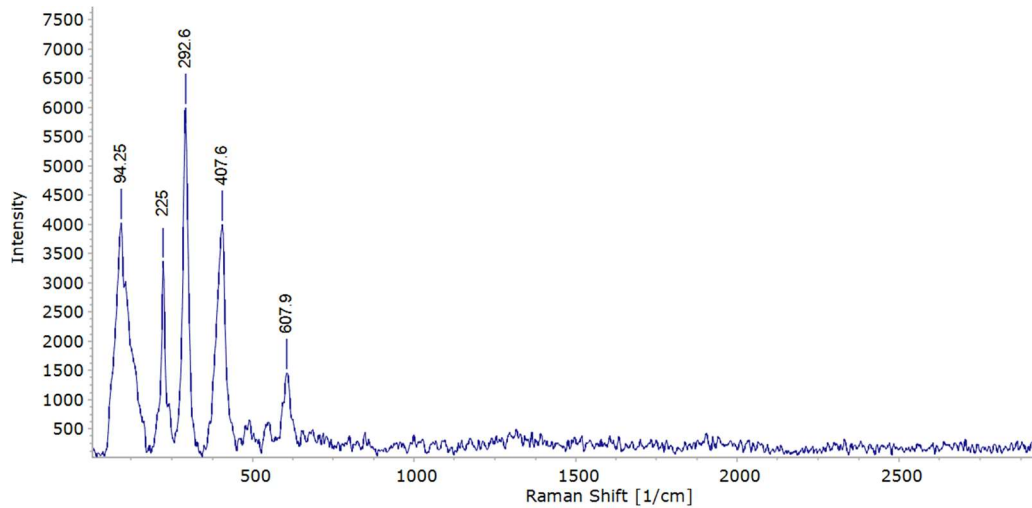
Detail of one of the studied samples: Gold with goethite and hematite.

Methods: XRF and Raman spectroscopy

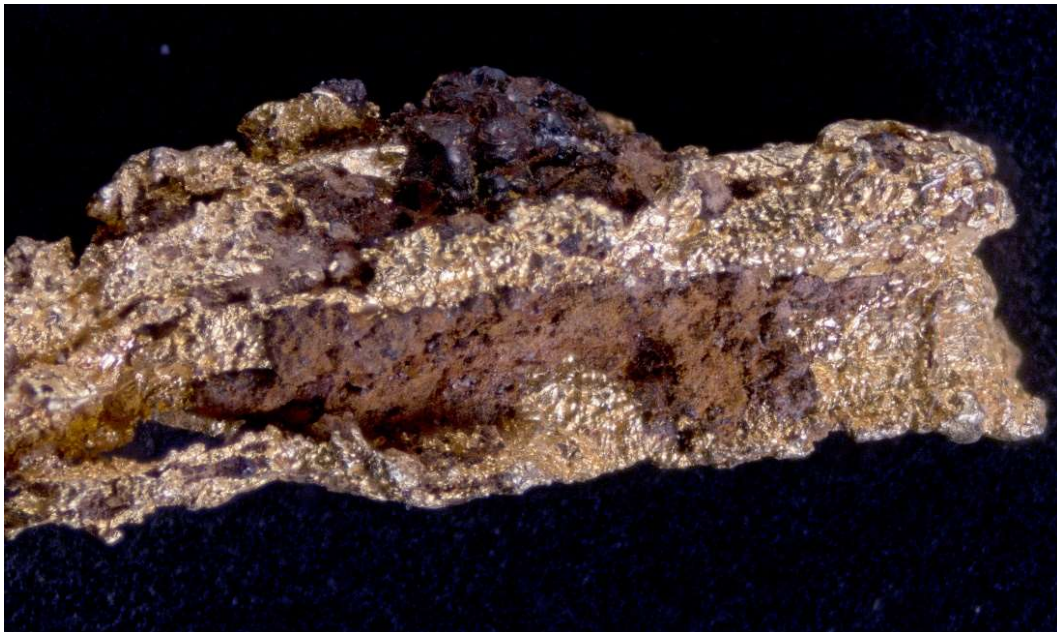
Results:

- Iron oxides

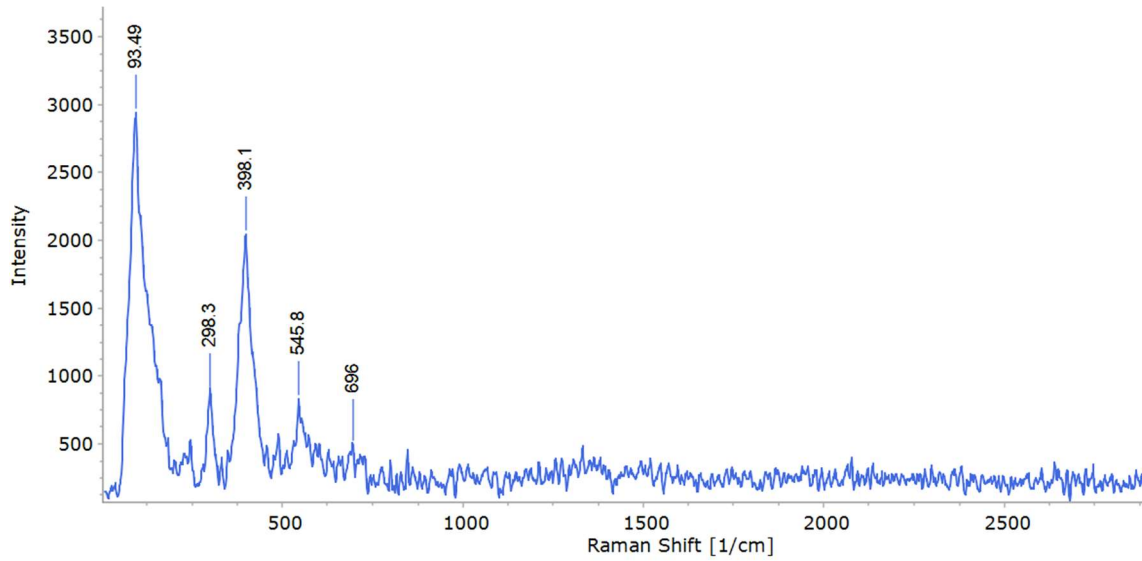
Identified goethite and hematite. Hematite occurs as pulverulent to spongy, brownish red material. Goethite shows botryoidal texture, dark brown to brownish or bluish black.



Raman spectrum of hematite on the gold samples



Hematite and goethite on gold. Hematite (lower half) appears as red to brown, dull, pulverulent material. Goethite (upper half) appears on typical black botryoidal material.



Raman spectrum of the goethite associated to gold

The close association of iron oxides with gold promotes the intensification of Raman signals, suggesting the syngenetic formation of gold and hematite-goethite.

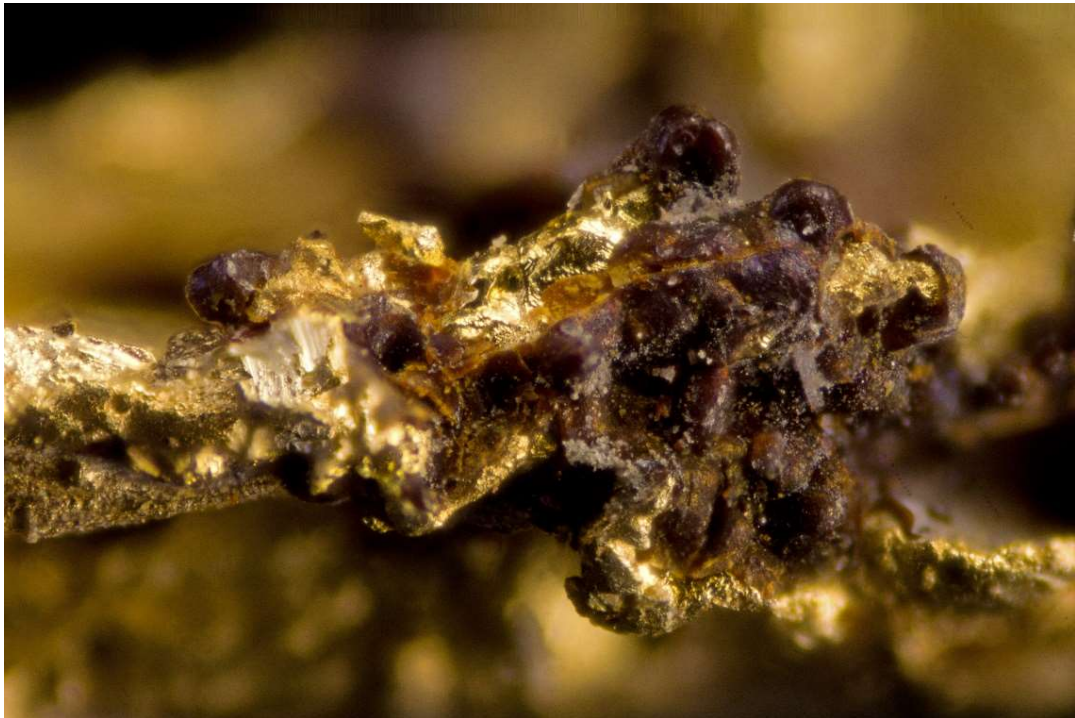


Goethite and hematite on gold. Iron oxides do not appear usually mixed, rather are forming differenced zones.



Goethite on gold

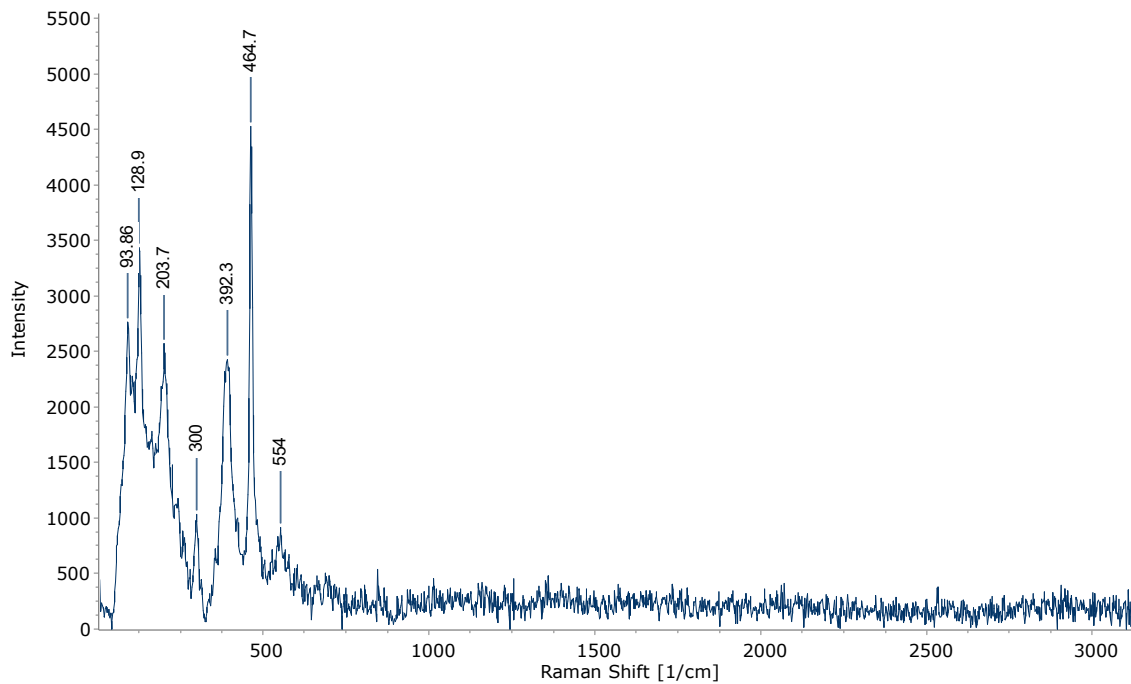
As a minor occurrence, quartz grains were found included in goethite and gold. No other minerals were found in the studied samples.



Goethite on gold, another view

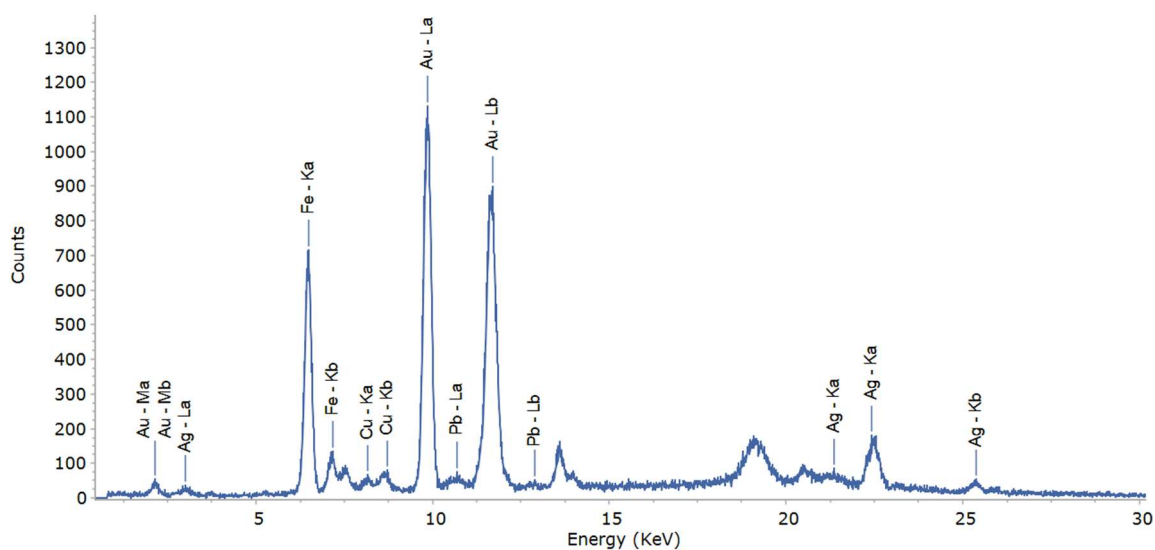


Hematite on gold

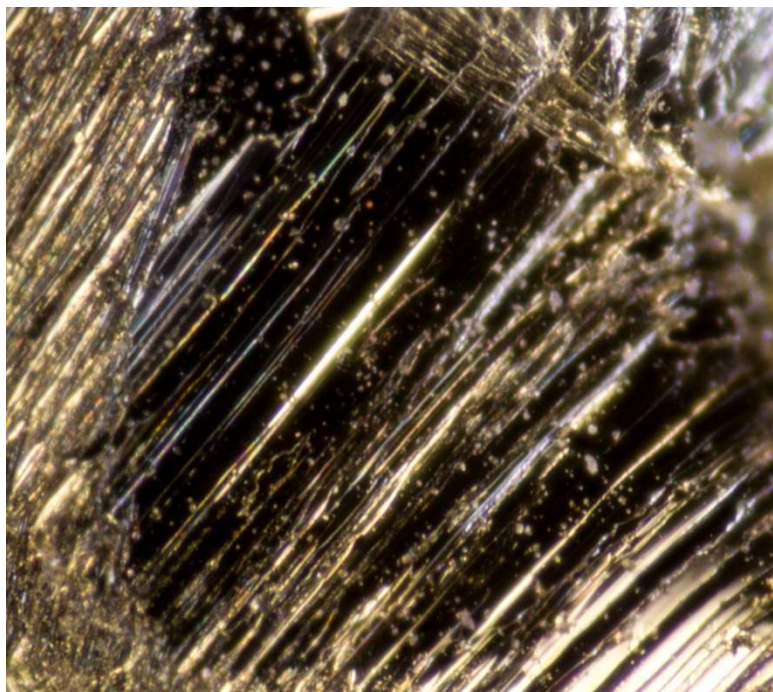


Raman spectrum of goethite containing quartz grains. Raman bands of quartz are shown at 464 and 554 cm^{-1} . Sample mineralogy is limited so far to gold, goethite, hematite and quartz as main minerals. No evidence of other minerals or artificial phases were found.

- Gold analysis

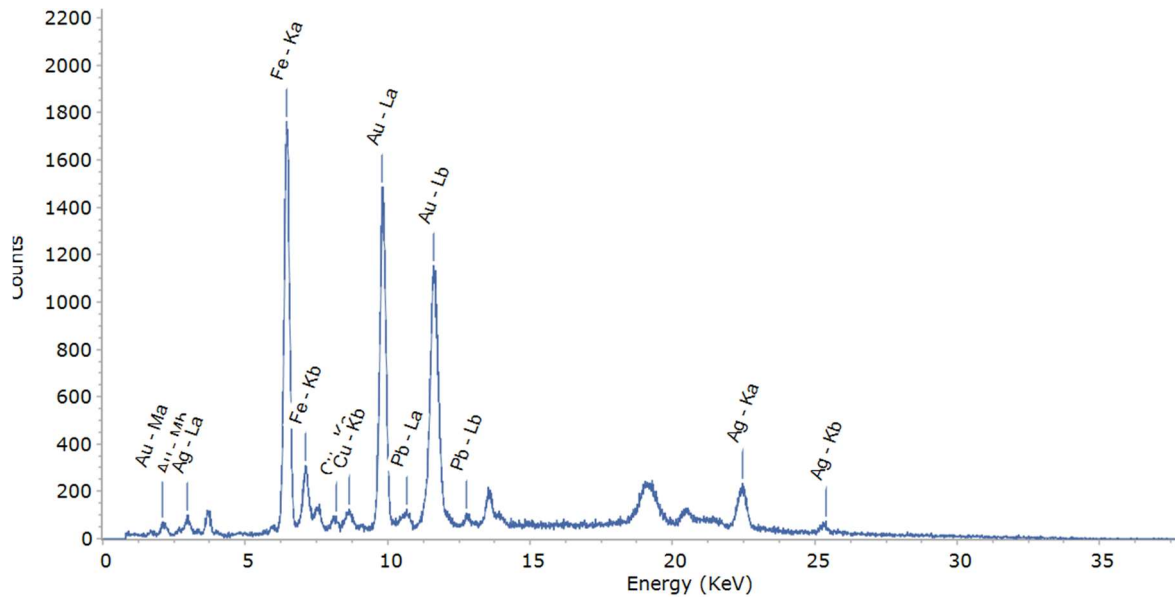


Composition shows variability depending on the presence of iron oxides. Gold found in the range 88.5 to 93%, with silver contents in the range 3-6.4% and traces of copper (approx. 0.2%) and lead (<1%). Iron oxide-rich zone of the samples shows copper and lead enrichment respect to the gold phase. Sample was cut to investigate zonations or wire as crystallization seed, and the composition found was uniform, with no evidence of significant zonation or crystallization cores.



Fresh transversal cut of a gold sample, previous to polishing. The metal composition is uniform in the transversal axis, with no evidence of presence of different phases or a seed wire.

Iron enriched zone:



In bulk, iron from iron oxides constitutes roughly the 5% of the metal content in the analyzed samples. Electrum denomination is considered roughly when Ag>20%

Sample identification: gold (silver-bearing gold) with goethite and hematite. Composition and mineralogy are consistent with a natural origin for the analyzed samples. The studied samples show no evidence of artificial origin or manipulation.

Analysis performed by Dr. Cesar Menor-Salván