

Screening tests for native platinum (Jacques Jedwab-jjedwab@ulb.ac.be)

Aim of the tests

The need for platinum field tests has often been expressed in this forum, and with the growing value of the metal, no doubt that more and more gold miners will reconsider the case. Indeed, Alaskan concentrates are known since old times to contain platinum in addition to gold. But when confronted with dense, grey metallic particles, the prospector/miner wonders if he has indeed found platinum, and if so, if the find deserves a further examination, with attached delays and costs. But he remembers also that he has been deceived more than once, and that the find could just be garbage, like iron (grey, shiny, dense, ferromagnetic, like platinum), or shot and solder lead (dull grey, dense, malleable, like platinum), the two most frequent and confusing contaminants in river concentrates.

There are of course serious methods for determining native platinum and other Platinum Group Minerals (PGM), but they demand well equipped labs run by trained professionals (assayers, chemists, spectroscopists, mineralogists), often operating far off from the field. And for the gold prospector, the problem remains of making an intelligent choice between rejecting the find as garbage, or deciding if the case deserves a professional determination. If he has no objective basis for an opinion, he is left with the unpleasant choice of either analysing everything, or discarding everything (except gold).

This note is an attempt to develop a screening tool aimed at:

- discarding metallic lead, lead/tin solder and metallic iron,
- getting a broad hint of native platinum, in order to decide if it's worth proceeding.

The principle is to let the mineral grains in contact with a non-specific reagent (aqua regia=aq. reg.) over a drawn-out experiment. One is thus supposed to store the tested mineral grains in a quiet, aerated, place, at temperatures above 10°C. for hours or days, and make time-delayed visual observations. (I ran my tests in a W. European lab, in january, at ca. 20°C.)

The tests are thus not aimed at determining other native metals (Bi, As, Ag, Cu),...or the numerous sulfides, arsenides, sulfosalts of heavy metals which could be present in concentrates. They are also of no help when one is confronted with PGM which are unaffected by aq. reg.: osmium-iridium alloys, cooperite/braggite (Pt,Pd,Ni)S, and laurite RuS₂. A list of aq.reg.-soluble PGM is not yet available, but it is known that sperrylite PtAs₂, laurite RuS₂, and platinum-iridium alloys are insoluble. Native palladium is soluble in conc. nitric acid.

Tested materials

Natural, native platinum: a sample of native platinum from Bear Creek, Seward Peninsula, AK, has been bought from a mineral dealer. It was composed of dull gray to brownish nuggets of about 1-2 mm.

Pure lead: Flakes cut from a foil of pure lead.

Lead/tin alloy: A concentrate bought from a mineral dealer, was said to come from Eastern D. R. Congo. This concentrate was composed mainly of native platinum, native gold, and gold/palladium/platinum alloys, but it contained also small disks (1 mm diam.) of a dull grey metal. They gave a probe composition of Pb-Sn. These disks displayed an oddity: they were all pierced by a small central hole, and after much pondering, I came to the conclusion that they were slices cut from a wire of electrical solder. I checked a small piece of genuine electrical solder from our lab, and it gave the same composition. (An obvious case of fraud by which the culprit managed to sell electric solder as “dirty gold”, but the price was affordable.)

Pure iron: A new nail was cut into flakes with an edge-tool.

Rusted iron: strongly magnetic particles were extracted with a hand magnet from a concentrate collected by Michel Zavadsky at Jessie Hill, Moore Creek, AK. Their colour was dark brown to black, with some metallic spots shining through gaps in the rusty crust.

Materials

- glazed porcelain spot plate, with 6 or 12 wells (note 1)
- plastic box with lid, large enough to contain the porcelain plate in a horizontal position (found in groceries), and to be left for a few days under its lid,
- 2 polythethylene droppers, 5, 10 or 25 ml (note 2)
- polythethylene pipettes,
- hydrochloric acid, HCl conc. (32 vol. %),
- nitric acid, HNO₃ conc. (65 vol. %),
- metallic tweezers with sharp points,
- magnifying glass or binocular (protect from corrosion by aq. reg.!).

Note 1. Porcelain plate may be replaced by a plastic packing (blister) of cough-drops. This contraption is of course very light and unstable, and should be examined against a white background.

Note 2. Plastic drop-bottles with tight stopper, of any pharmaceutical eyewash, are fine. The pipettes will be used for replenishing the drop-bottles.

Operation

Each well receives 3 drops of HCl and 1 drop of HNO₃.
A particle is deposited in each well.

- 1) Observations to be performed immediately:
 - pure iron and aged iron release abundant gas bubbles,
 - lead is not affected,
 - solder becomes immediately coated with a white crust,
 - platinum is unaffected.

2) Observations to be made after 1-2 hours:

- iron is still bubbling, and one notices some dissolution,
- lead begins to be coated with small white crystals,
- solder gets a clear white crust,
- platinum takes-on a very slight shine.

3) Observations to be made after 48-72 hours:

- iron is dissolved,
- lead is covered with small white crystals, but the grey underlying metal is still visible,
- solder changes to a white powder, or to white fragile blocks,
- platinum gets a definite silvery grey shine, best visible against untreated grains (cf. figure).

(After these 2-3 days of limited dissolution, the solutions left by platinum grains are light green, yellow or brown, and can be used to perform microchemical tests. The potassium sulphate test is specific, but one needs a transmitted light microscope.)

Figure Caption

Native platinum nuggets from Bear Creek, Seward Peninsula, AK.
Millimetric scale.

3 left columns: untreated (as received).

3 right columns: cold aq. reg. treated for 48 hours. (the black particle to the left turned out to be a mixture of Ru, Rh, Os and Ir minerals, unnoticed before treatment).

