

Copy of Canadian Patent Application
ASSAY BY SMELTING: Precious Metal Analysis And Production.

By

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ABSTRACT:

A chemical and physical process, initially smelting a precious metal resource, comprising metallic and/or ionic precious metals, in a container, in a virtually oxygen-free reducing atmosphere, by heat, beyond the melting point of a precious metal to be recovered, in order to change, and to concentrate, ionic metals, into molten, cooled, crystallized, elemental metals, and subsequently submit a precious metal to dissolution in acid for analyses, for precipitation, and for refining.

Outline/Links on Specific Interests:

- 2.0. [Description Of The Process:](#)
 - 2.2.0. Method Of Smelting And Extraction.
 - 2.3.0. [Experimental Details](#) And Results Of Smelting And Extraction.
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[CLAIMS](#)

[Photo of Metals](#), Produced from Test Samples.

TITLE: **ASSAY BY SMELTING: Precious Metal Analysis And Production.**

DESCRIPTION:

1.0. Background And Issues Regarding Precious Metals.

1.1 In 1983, 34 years ago, the inventor set out to discover the source of Williams Creek placer gold, a task, which so far had eluded everyone, for the host country rock does not seem to justify such large amounts of placer gold. (1 Km of Williams Creek, at Barkerville, B.C., produced about 20 cubic meters of melted gold.) In this Patent Application, the inventor reveals the source of the Barkerville gold. But contrary to conventional thinking, the discovery of gold and precious metals does not depend on location (such as the vicinity of Barkerville); the key to success is in proper analysis and recovery.

1.2 Like many a treasure hunter, the inventor seemed to have failed in his quest. After 30 years of endless study, toil, and many disappointments, he was ready to abandon his pursuit. Yet, thanks to someone, who presented to him an extremely refractory and highly concentrated natural resource, which had been previously subjected to extensive testing, and which was found to be very rich in the Platinum Group Metals (but for which no one had devised a workable method of extraction), the inventor was presented with the twofold challenge: (1) Verify established values of this specific resource and (2) devise an effective method for large-scale precious metal production. (Cf., 2.3.4. This led him back to the Barkerville quest.)

1.3 As hidden locations of gold are the intrigue that fuels elusive treasure hunting, analysis and recovery of precious commodities are often shrouded in proprietary and secretive knowledge. Though, the substance of this invention may already be the proprietary knowledge of a select few, who for reasons of their own may want to keep it that way, the public disclosure of this invention irreversibly alters production

of gold and precious metals. For what may have been the secretive knowledge of a select few, now, by virtue of this patent disclosure, is effectively public domain.

2.0. Description Of The Process:

2.1. Smelting.

Since the inventor was dealing with a clean, highly concentrated natural resource (cf., 1.2.), the inventor decided to forego acid digestion of ore, as he described in previous Canadian Patent Applications. He proceeded directly with smelting.

2.2.0. Method Of Smelting And Extraction.

2.2.1. The inventor took 5 grams of the above pulverized concentrate (cf., 1.2.) and placed it into a tubular, graphite crucible, having an exterior diameter of 1.25 centimeters, into which was drilled a hole, approximately 7 cm deep and .5 cm in diameter. Into 1 centimeter of the crucible top, the inventor inserted alder wood (in lieu of using a sealed induction furnace) to shield the content of the crucible with carbon. In this First Melt, the inventor heated all exterior sections of the crucible for one or two minutes by a propane oxygen torch to the maximum heat (about 2,500 degrees Celsius). The alder wood was immediately transformed into charcoal, which absorbed atmospheric oxygen from within the crucible, and thus created and maintained a virtually oxygen-free reducing environment for the melt. After every exterior section of the tubular crucible was heated to the maximum, the inventor let the crucible cool and examined the cylindrical fused residue. On the exterior of the melt were embedded numerous metallic beads.

2.2.2. The inventor crushed the First Melt residue to liberate microscopic beads from within the slag. Then he gravimetrically separated, by washing, the slag from metallic crushed beads. To amalgamate this metallic concentrate, the inventor re-applied the above-described heating process in a Second Melt. The Second Melt normally fused the crushed metal concentrate of the First Melt and produced a nonmagnetic, silvery, partially golden, brittle, conductive, metallic composite, a solitary bead, or, if sufficient metallic matter was present, an elongated metallic slug, which in effect was the collector.

2.2.3. If the Second Melt (bead or slug) reacted to hydrochloric acid, the inventor crushed it again and submitted it to a hot 20 % hydrochloric acid dissolution. When the hydrochloric acid leach was completed, the inventor rinsed the remaining residue with water, submersed the residue in precious metal soldering flux, and dried it before fusing it by a Third Melt. If the potential of the Third Melt promised to contain significant portions of platinum and gold, the inventor retained the Third Melt in its hot liquid state, for an extended period of time, to allow platinum and gold to segregate, which provides for easy visible preliminary identification of gold.

2.2.4. If the Second Melt produced a sizeable slug (effectively the collector), which was not soluble in hydrochloric acid, the inventor used the slug as a donor electrode to dissolve it in a hydrochloric acid electrolyte, to which he applied a 5 to 15 Volt Alternating Current power supply. (For safety reasons never apply a Direct Current for this application.) Since the Platinum Group Metals and gold are on record of being insoluble in hydrochloric acid, and since iridium, platinum, as well as rhodium, even serve as refractory insoluble donor electrodes, any insoluble metallic residue of the electrolytic dissolution process was regarded, tested and processed as the precious metal rhodium, iridium, and platinum.

2.2.5. Since copper, gold and palladium donor electrodes readily dissolve in a hydrochloric acid electrolyte, upon completion of the electrolytic dissolution process, into the electrolyte of the above electrolytic solution was introduced metallic iron, which retained in the electrolyte any iron that was already dissolved and all base transition metals, which have a Standard Reduction Potential that is lower (more negative) than the Standard Reduction Potential of iron (such as, W, Ni, Co, Cr, V, Mn, et. al.), but which precipitated from the electrolyte all precious metals, which have a Standard Reduction Potential that

is greater than the Standard Reduction Potential of iron. (Such as, Cu, Ag, Au, Ru, Os, Rh, Ir, Pd, and Pt, even Re. Since a propane torch cannot melt ruthenium, osmium, and rhenium; Ru, Os, and Re were deemed absent.)

2.3.0. Specific Experimental Details And Results Of Smelting And Extraction.

2.3.1. **For Experiments 1 to 11** the inventor smelted the above concentrated precious metal resource (cf., 1.2.). As may be expected, the results of Experiments 1 to 11 appeared to be virtually identical for the First Melt. The Second Melt of Experiments 1 to 11 produced a metallic slug, on average weighing 3.07 grams, which is 61.4 % of the original 5 gram sample. Since the slugs did not react to hot hydrochloric acid, the inventor dissolved the slugs, by using them as donor electrodes in an electrolytic dissolution process, comprising a hydrochloric acid electrolyte and an Alternating Current power supply. When dissolution was complete (after many hours, one of the two electrodes was totally consumed), the inventor concentrated and refined the insoluble iridium, platinum, and rhodium residues; and he extracted from the hydrochloric electrolyte the dissolved precious metals copper, gold, and palladium by precipitating them with iron, as described above (cf., 2.2.5.). After precipitation with iron, the inventor checked by electro-precipitation to see if precipitation by iron was complete. When the inventor rinsed, dried and fused the precipitates, visible copper and gold spheres could be seen partially imbedded within the palladium; the spheres were thus formed for copper and gold remain as spherical liquids, even after the palladium solidifies. (m.p.: Pd, 1552° C; Cu, 1083° C; Au, 1063° C.)

2.3.2. **For Experiment 12**, the inventor smelted a 5 gram cross section ore sample from the former mining property (in the Cariboo Mining Division of British Columbia) of an acquaintance, who had received conflicting testing results for his ore. (Standardized analyses by the mining industry reported no commercial values on his mineral claim; but undisclosed secretive method of analysis reported 268.5 ounces of gold and 37.32 ounces of silver per ton.) The Second Melt for Experiment 12 produced such a large bead of precious metals that it could be manually picked up. Projecting the amount of visible gold, coming from this 5 gram test sample, to a per ton basis, (5 gram to 1,000 Kg is a ratio of 5/1,000,000 or 1/200,000), seemed to verify “secretive analysis.” Contrary to commercially, industrially accepted and promoted analyses, the value of said mining property may indeed be in hundreds ounces of precious metals per ton of ore.

2.3.3. **For Experiment 13**, the inventor smelted a 5 gram cross section ore sample from his elapsed mineral claim (in the Cariboo Mining Division of British Columbia), which the inventor had personally submitted to commercial laboratory testing, but again commercial analyses reported the virtual absence of precious metals. Yet the inventor’s prospecting experience convinced him that such an ore has a very high potential; hence he decided to apply this new testing procedure to this ore. The First Melt of Experiment 13 produced innumerable microscopic copper, silver, and gold-colored beads. But the Second Melt, instead of amalgamating the great number of small beads into one, made them virtually disappear, which is an indication that silver is present, for melted silver engages in “spitting” and disperses the melt, as it evaporates at 2,210 degrees Celsius, which can be avoided by previous separation of silver with nitric acid rinsing, or applying heat less than 2,210 degrees Celsius, instead of the 2,500 degrees Celsius, as described in above paragraph (cf., 2.2.1).

2.3.4. **For Experiments 14, 15, and 16**, the inventor smelted three arsenopyrite samples (4, 4, and 8 grams respectively) from the “*B.C. Vein*” (which crosses Williams Creek at Barkerville, in Cariboo Mining Division of British Columbia) according to the method of ASSAY BY SMELTING as defined above. The Second Melt produced a metallic slug, which the inventor submitted to a hot hydrochloric acid leach for it readily dissolved what appeared to be an iron collector. The inventor fused the residual black residue, which produced visually identifiable gold beads, which considering the size of a 4, 4, and 8 gram test samples, ratios 1/250,000 and 1/125,000, translates into potentially 100’s of ounces of gold per ton. The inventor’s previous commercial testing of the same type of ore (*B.C. Vein*) from one of the inventor’s former mineral

claims had produced a big zero. (Cf., 1.1. The host country rock in the Barkerville vicinity is indeed capable of producing 20 cubic meters of gold in 1 km of Williams Creek. The inventor reached his objective: He discovered the source of the Williams Creek gold.)

3.0. Chemical And Geological Rationale, Summary, Differentiation, Usefulness, And Verification.

3.1. Chemical And Geological Rationale: Elemental substances comprise, not just three but, but at least five distinct physical states. In addition to the three atomic states: solid, liquid, gas, there are two additional (solid and liquid) ionic states. Ionic metals have an electron deficiency from atomic metals, i.e., a positive charge. Elemental metals, when in an ionic molecular solid or liquid state, are absolutely changed beyond recognition and relinquish every metallic characteristic. The various and uniquely different physical characteristics and combinations of ionic metals is beyond imagination, because the number of possible complex ionic configurations of molecular metals is nearly infinite. The identification of complex ionic Platinum Group Element and gold compounds is even more difficult, because gold and the PGE are frequently ionically linked. A virtually foolproof method of identifying precious metals is to reduce them from complex ionic configurations to simple solid metallic crystal structures, which can be achieved in two ways: (1) As hot liquid metal cools it crystallizes; or, (2) metal is deposited electrolytically. This invention utilizes option (1), in which the electropositive charge of complex precious metal ions are reduced to become free-flowing atomic elements, which, when cooled, crystallize in their elemental atomic state, as which they are no longer attached as positively charged anions that comprise complex molecular structures.

3.2. Summary: Thus the key to effective and accurate precious metal testing and production is essentially two-fold, ASSAY BY SMELTING: (1) Reducing precious metals at a temperature that is higher than the melting point of the precious metals to be assayed and produced; and (2) as said metals cool, they crystallize into solid identifiable crystal structures, be separated from host rock slag and other metals, be quantitatively identified, refined, and produced.

3.3. Differentiation: The descriptive title, ASSAY BY SMELTING, distinguishes this invention from the ineffective Fire Assay Method. The collecting method of the archaic Fire Assay falls short primarily in at least three respects: (1) The melting point of platinum ($1,769^{\circ}\text{C}$), is higher than boiling point of the Fire Assay lead collector ($1,725^{\circ}\text{C}$). (2) Fire Assay collecting temperatures vary around 1,000 degrees Celsius and can be lower than the melting point of gold (1063°C). (3) Simply roasting metals salts and oxides in lead oxide may liberate some metals of sulfides, but that does not necessarily liberate precious metals from complex ionic intermetallic molecular structures. (E.g.: In roasted arsenopyrite of Experiment 10, 11, and 12, gold is still ionically linked with non-metallic ionic iron, nickel, and/or cobalt and thus gold eludes the Fire Assay lead collector.)

3.4. Usefulness: By implementing this Patent Application, ASSAY BY SMELTING, the public is empowered to test and produce precious metals, even Platinum Group Metals, visible and tangible gold, on a scale, rarely seen before. In fact, new, heretofore un-tapped, natural resources are made accessible and proven productive. Whereas, the present-day precious metal mining industry is almost exclusively focused on sulfide mining, ASSAY BY SMELTING reveals, exposes and makes accessible precious metals that are ionically and in-accessibly locked-in; being molecularly part of silicates, they are shielded by complex, refractory, acid-insoluble oxides.

3.5. Verification: The iron blast furnace pig iron production is irrevocable proof that ASSAY BY SMELTING does what the inventor claims. The technical distinction between a blast furnace and this invention is simple: (1) In a blast furnace, the required heat and reduction is generated by burning coal within the ore. (2) In this invention, the required heat is supplied from an exterior source; be it by flame, or electricity; (3) and a reducing, oxygen-deprived atmosphere is artificially and mechanically maintained.

CLAIMS:

THE EMBODIMENTS AND THE PROCESS OF THE INVENTION, IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED, ARE DEFINED AS FOLLOWS:

1. A chemical and physical process, initially smelting a precious metal resource, comprising metallic and/or ionic precious metals, in a container, in a virtually oxygen-free reducing atmosphere, by heat, beyond the melting point of a precious metal to be recovered, in order to change, and to concentrate, ionic metals, into molten, cooled, crystallized, elemental metals, and subsequently submit a precious metal to dissolution in acid for analyses, for precipitation, and for refining.
2. A process, as defined in claim 1, in which a precious metal is a metal, which has a Standard Reduction Potential that is higher than the Standard Reduction Potential of iron.
3. A process, as defined in claim 1, and 2, in which a precious metal is copper.
4. A process, as defined in claim 1, and 2, in which a precious metal is silver.
5. A process, as defined in claim 1, and 2, in which a precious metal is gold.
6. A process, as defined in claim 1, and 2, in which a precious metal is rhodium.
7. A process, as defined in claim 1, and 2, in which a precious metal is iridium.
8. A process, as defined in claim 1, and 2, in which a precious metal is palladium.
9. A process, as defined in claim 1, and 2, in which a precious metal is platinum.
10. A process, as defined in claim 1, and 2, in which a precious metal is rhenium.
11. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 in which a precious metal resource, comprising metallic and/or ionic precious metals, is placed into a container.
12. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11, in which a container is neutral and does not, when heated, cause a chemical interaction with a precious metal.
13. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12, in which a container can withstand the highest melting point temperature of the anticipated metals to be recovered.
14. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13, in which a container is a graphite crucible that is small enough to accommodate less than 5 grams of a precious metal resource.
15. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13, in which a container is a crucible that is large enough to accommodate at least 1 kilogram of precious metal resource.
16. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15, in which precious metal resource content within a container is chemically shielded from atmospheric oxygen by carbon.
17. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16, in which heat is indirectly applied to a precious metal resource via a container, by a burning fuel, or electrically.
18. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17, in which the amount of heat applied to a precious metal resource is in excess of the melting point, but not in excess of the boiling point, of a precious metal to be produced.
19. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 18, in which a precious metal is allowed to cool to ambient room temperature.
20. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19, in which precious and non-precious metallic constituents are separated from slag.
21. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20, in which the procedures, defined in Claims 11 to 20, may have to be repeated, considering that the boiling point of some precious metals is lower than the melting point of other precious metals.
22. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, and 21, in which precious and non-precious metallic constituents are submitted to leaching in hot hydrochloric acid.

23. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, and 21, in which precious and non-precious metallic constituents are submitted to leaching in nitric acid.
24. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, and 21, in which precious and non-precious metallic constituents are submitted to leaching in a combination of acids.
25. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, and 24, in which a dissolved precious metal is precipitated by a metal, which has a Standard Reduction Potential that is lower than the Standard Reduction Potential of hydrogen.
26. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, and 25, in which a dissolved precious metal is precipitated by iron.
27. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, and 24, in which a dissolved precious metal is electro-precipitated.
28. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, and 27, in which a precious metal is submitted to analysis.
29. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, and 27, in which a precious metal is submitted to refining.
30. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, and 21, in which a precious metal and metallic constituents are fused to serve as a donor electrode in an electrolytic dissolution process.
31. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, and 30, in which an electrolytic dissolution process has an acidic electrolyte.
32. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, and 31, in which an electrolytic dissolution process has a hydrochloric acid electrolyte.
33. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, and 32, in which an electrolytic dissolution process has an Alternating Current electric power supply.
34. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, 32, and 33, in which an insoluble residue of an electrolytic dissolution process is submitted to analysis.
35. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, 32, and 33, in which an insoluble residue of an electrolytic dissolution process is submitted to refining.
36. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, 32, and 33, in which a dissolved precious metal is precipitated by a metal, which has a Standard Reduction Potential that is lower than the Standard Reduction Potential of hydrogen.
37. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, 32, 33, and 36, in which a dissolved precious metal is precipitated by iron.
38. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, 32, 33, and 36, in which a dissolved precious metal is electro-precipitated.
39. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, 32, 33, 35, 36, 37 and 38, in which a precipitated precious metal is submitted to analysis.
40. A process, as defined in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, 32, 35, 36, 37, and 38, in which a precipitated precious metal is submitted to refining.

Photos of Metals
Produced from Test Sample

