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The precious metals we prefer to ignore

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ABSTRACT

Based on publicly available information and the author's experience, there is reason to suspect that high levels of precious metals may be extracted economically from non-assayable materials. Such proprietary recovery methods have been demonstrated only at laboratory or pilot scale, so that the credibility associated with large scale production is still lacking. Precious metals not detected by spectroscopy and standard assay techniques are usually assumed not to exist, and hence present a technical and credibility challenge to metallurgists interested in these 'abnormal' ores. It is unlikely that this demanding field of metallurgy will be addressed by academic researchers or large companies, despite the substantial opportunity that it offers for breakthrough discovery. This paper reviews some of the pseudo-science surrounding this field, including: (a) the role of 'intermolecular water' in forming complex salts locking up precious metals, but which also presents a basis for extraction of precious metals from non-assayable ores; (b) accounts of ambient transmutation of elements, mainly using thermal methods; (c) Orbitally Rearranged Monoatomic Elements (ORMEs) which are virtually undetectable by conventional means and their conversion to normal metals; (d) the 'high spin' state of transition metals; and (e) the formation of microclusters altering the chemical behaviour of precious metals. It is hypothesised here that precious metals occur in nature across a spectrum of degrees of clustering, ranging from 'normal' gold amenable to conventional extraction methods, to the ORME state.

1. Introduction

Much has been written about the detection and recovery of so-called 'invisible' gold, although less information is available on the detection of platinum group metals (PGMs) in refractory ores (Genkin et al., 1998; Hough et al., 2008; Maddox et al., 1998; Palenik et al., 2004). Goodall and Scales (2007) presented an overview of automated detection methods for 'invisible' gold based on modern scanning and spectroscopic technology. In published studies on this subject there is usually no discussion about the potential discrepancy between using spectroscopic methods based on the orbital electron structure of the metal on the one hand, and methods based on the properties of the nucleus, such as mass spectroscopy or neutron activation, on the other hand. Experience by Jannie van Deventer (JvD) has shown that conventional analytical techniques such as Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AAS) involving a dissolution step are unreliable for the quantification of 'invisible' precious metals. Moreover, all these analytical methods, even those that do not involve an undesirable chemical step such as dissolution, assume that precious metals present in an ore will be detectable. Conventional scientific wisdom does not allow for the possibility that precious metals not detected by any analytical method, including highly sensitive neutron activation, could indeed be recovered using unconventional methods.

A case in point is the publically available information on recoveries from Bamboo Creek iron-rich tailings of Haoma Mining NL in Australia (Haoma Mining, 2013). Fire assays conducted by a reputed independent laboratory on these materials yielded on average 0.3 gAu/t. When Haoma Mining subjected the tailings to a pilot scale concentration process and applied the proprietary 'refined Elazac assay method,' the product yielded in excess of 1000 g gold, platinum and palladium per ton, and was acceptable to refineries. This product assay was back-calculated to a tailings head grade exceeding 140 g precious metal per ton. Another case is Royal Mines and Minerals Corporation in the USA. that used their proprietary 'Cholla' process to recover in excess of 60 gAu/t from fly ash which in its untreated form gave 0.01 gAu/t in a fire assay (Snaper, 2012). It is JvD's experience that several materials not classified as 'ores' may yield very high recoveries of precious metals when subjected to proprietary extraction methods. Unfortunately, such methods have been demonstrated only at laboratory or pilot scale, so that the credibility associated with full scale production is still lacking.

This huge discrepancy between different assay methods is not uncommon. The nugget effect and spotty gold coupled with inadequate sample size, as well as accumulation of gold in processing equipment, are common reasons why metallurgists struggle to reconcile their head and tailings assay values with the actual gold

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recovered. This paper is not concerned with such conventional discrepancies, but instead will focus on ‘abnormal’ explanations for unusually high recovery of precious metals from ores which show much lower values using conventional assay techniques.

It is the aim here to review unconventional observations, pseudo-science and hypotheses for the recovery of ‘non-assayable’ precious metals, referencing information that will not withstand a peer review process, or is unlikely to be considered by main stream research. The metallurgical community will likely continue to reject many of these ideas as lunacy, but it is suggested here that some of these ideas deserve investigation by scientists with an open mind.

2. ‘AB bubbles’

Late 2010 JvD visited Frank Andres in Spokane, Washington State, as well as Dr. Franklin Bailey at the University of Idaho, Moscow. They both confirmed much of the information available on the web (Bailey and Andres, 2009) to JvD. Frank Andres showed JvD how the ‘AB bubbles’ formed and how they extracted precious metals from different ore particles, with metals like gold, platinum and rhodium clearly visible under the microscope. The identity of these formed metals was confirmed by Franklin Bailey using Energy Dispersive X-ray Spectroscopy and Scanning Electron Microscopy (EDS–SEM).

This story started in 1974 at the Yuba Goldfields, a 10,000-acre valley on either side of the Yuba River in northern California (http://en.wikipedia.org/wiki/Yuba_Goldfields), where Frank Andres was the general manager of the site supervising a large gold dredging operation. He noticed that year after year the gold recovery of the dredged material did not decline, contrary to expectations. It appeared that increasing amounts of gold became ‘liberated’ as dredging proceeded. One day, Andres discovered an impure gold nugget with an odd white material growing in the cracks and fissures. He put the nugget in a Petrie dish with hydrochloric acid, where it was still late 2010. Andres retained the odd piece of gold and forgot about it until the mid 1990s, when he discovered that the white substance had purified his nugget into 24-karat gold.

Andres then placed the white substance in the same hydrochloric acid with a piece of copper. The copper turned clear and nearly invisible. When Andres examined this white substance under the microscope, he found bubbles and called them ‘AB bubbles.’ The bubbles appeared to extract trace amounts of precious metals from any object imaginable (Fig. 1). For example, Andres observed that the ‘AB bubbles’ grew tendrils of precious metals out of pomegranates, grapes, iris flowers, cherry pits, blackberries and even Andres’s bathroom sink. It is noteworthy that most of the materials used as a substrate by Andres do not reveal precious metals when subjected to spectroscopic analysis, including neutron activation. The ‘AB bubbles’ grow these long, colourful tendrils that are made up of different precious metals. Different metals produce different coloured growths: blue, red, clear, amber, green or multi-coloured. The ‘AB bubbles’ are very small and no work has been done to see whether their production and application could be scaled up for commercial use in mineral processing. Andres suggested that they could be used for exploration purposes to find new deposits.

Some scientists dismiss the ‘AB bubbles’ as hydrogen bubbles, or other natural forming gas, escaping from the minerals when hydrochloric acid is applied. However, Bailey rejected this simple explanation, as the bubbles appear to have a membrane that protects the interior. When the solution is removed, the bubbles dry out, but they do not go away and remain intact. Then, when a liquid is reapplied, the bubbles become active again. Andres said that when precious metal has been extracted by the bubbles and the pH changes, the precious metal may ‘disappear’ again, and reappear when the pH shift reverses.

There is speculation whether the ‘AB bubbles’ or the white substance found on the nugget by Andres is biological or indeed alive. Andres and Bailey believe that they could be byproducts of other living organisms, for example they may be the result of the interaction between a bacterium and fungus. The white substance originally found on the gold nugget, and since used in experiments by Andres, appears to be a fungus, although scientists still are unsure. Bailey speculated that the bacterium that is interacting with the fungus could be located inside the mycelia of the fungus. Microbiologists Dr. Susan Childers and Prof Larry Forney at the University of Idaho have started to do research on these substances, but have not drawn any conclusions (Bailey and Andres, 2009).

It is disappointing but not surprising that the work of Andres and Bailey has not been taken up by mainstream researchers or industry, especially in view of its profound implications for precious metal recovery and our understanding of the chemistry of precious metals.

3. Gold nanoparticles

The gold extracted by the ‘AB bubbles” of Frank Andres is quite different from the gold nano-particles and biofilms identified in nature by Rob Hough and co-workers of CSIRO in Perth (Hough et al., 2008; Reith et al., 2010). The gold nano-particles identified by the Hough team are detectable by high precision analytical instruments, while the precious metals in plant material, etc. prior to extraction are not detectable by any existing method of analysis.

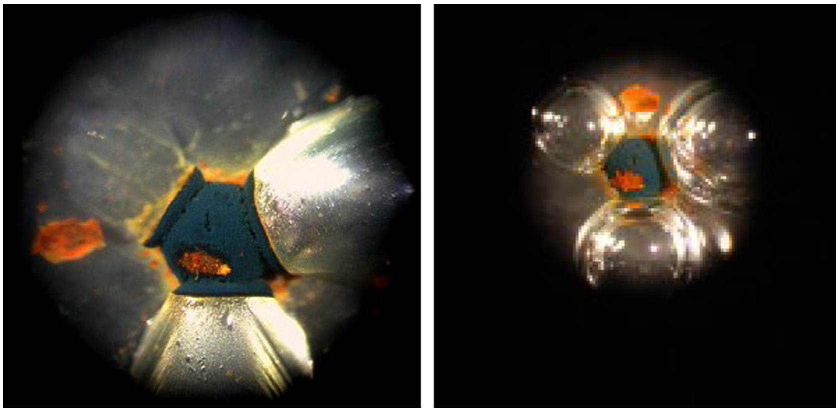

Fig. 1. ‘AB bubbles’ collaring to a mineral particle, observed by Bailey and Andres (2009).