EXCERPTS and NOTES (Section 5a: from Antonil to Jedwab 1994)

Antonil 1711
p. 363: *"As for the various sorts of gold, it is known that the one called ouro preto, because of its surface is colored like unburnt steel, appears with a vivid yolk yellow color when tried under the teeth. It is the finest gold, since it is almost 23 carats."* [Transl. from A. Mansuy's French text].

Augé & Legendre 1994a
p. 999: *"Iridium oxide. Optical characteristics of the iridium phase [consisting of a prismatic assemblage of crystals up to 150x40 µm] (very low reflectance for a PGM), together with a low analytical total, led us to further investigate this phase. An energy-dispersion spectrometer with a light-element detector was used, and the presence of significant amount of oxygen was revealed. On the basis of the Ir content of the mineral, the formula IrO_2 is proposed [...] Several features lead us to favor a primary origin for this oxide."* [see also Legendre and Augé, 1993].

Augé & Legendre 1994b
From the abstract: *"A number of platinum-group element oxides and hydroxides have been discovered in a PGE mineralization in the New Caledonian ophiolite complex. They include Pt-Fe oxides containing variable amounts of oxygen (5-50 at.%), Ir-Fe-Rh oxides (metal/oxygen=~3), Fe-Rh-Pt oxides and Pt-Ir-Fe-Rh oxides (metal/ oxygen=1), and an Ru-Mn-Fe phase with a very low metal/oxygen ratio interpreted as hydroxide [....] The PGE oxides may result from the alteration of magmatic PGM alloys and from primary crystallization of oxide in lateritic conditions."* [Numerous figures and analyses with textural and paragenetic observations.]

Augé & Maurizot 1995a
From the abstract: *"PGE oxides have been recognized in the chromitite horizon and in the placer deposits. The formation of these PGE oxides is related to intense laterit-ization affecting the primary mineralization. Some oxides are the products of oxidation of pre-existing PGM, whereas others seem to have crystallized in laterite. This indicates a certain mobility of the PGE during the lateritic alteration."*
p. 1035: *"The compositions of the Pt-Fe oxides from the chromitite mineralization [...] show a wide Pt-Fe compositional range and Cu enrichment at a constant Pt/Fe ratio. Pd and Rh are the only PGE present in significant amounts in these minerals (ranging, respectively, between 0.2 and 4.2 wt.%, and 0 and 0.5 wt.%). The Cu content reaches 16.8 wt.%, and Ni also is invariably present. [...] The compositions of the Pt-Fe oxide from the Ni Estuary alluvium [...] are marked by a Pt/Fe atomic ratio close to unity and a low Rh content [...] A wide range of oxygen contents has been recorded, from 1.0 wt.%...to 10.4 wt.%. The increase in oxygen does not modify the Pt/Fe ratio, which remains, with few exceptions, close to 1. High Pd contents (average 2.9 wt.%, maximum 13.4 wt.%) have been recorded in the oxides."*

Augé & Maurizot 1995b
From the abstract: *"Lateritic weathering strongly affects primary mineralization through alteration of the carrier minerals. This leads to the dissolution and transport of PGE, which recrystallize as new minerals in the laterite, in particular as Pt-Fe oxides. Such minerals have a characteristic texture that resembles iron concretions."*
p. 13, *"Table 5: unnamed Pt-Ir-Fe-Rh oxides; unnamed Ru-Mn-Fe hydroxide."*
p. 17, "Fig. 8,E: Pt-Fe oxide with a strong zonation."

Barkov et al. 1999
[The physical, chemical and paragenetical properties of Pd_9PbO_{10}, and a fine-grained Pd-Pb-(Cu-Fe) oxide, found in the deposit of Kirakkajuppura deposit, are reported. These oxides result mainly from the late stage, hydrothermal alteration of zvyagin-tsevite.]

Bowles et al. 1995
p. 72: *"We have shown that there are sound theoretical reasons to anticipate an involvement of organic materials in the weathering of PGE deposits and that a wide range of active organic compounds are*

present in a PGE-bearing lateritic soil. The organic components of soils appear to concentrate the PGE and the experimental results show some 2 to 200 ppb platinum in solution after only 393 days."

Buttgenbach (1947)
p. 35: *"At Shinkolobwe, black oxides found in the washing concentrates also contain Pd. This metal, as well as Pt, are present as oxides or sulfides, and this should also be the case at Ruwe*." [This probably refers to the same material described by Thoreau and du Trieu (1933), but the hypothesis of palladium oxides or sulfides is nowhere supported by analysis, although postulated as early as 1904 by Buttgenbach himself].

Cabral et al. 2001
From the abstract: "*A variety of PdO species is documented, always in association with Cu, Fe and Mn* [and Hg]*, and includes $Pd(OH)_2$ or $PdO.H_2O$, and phases with metal excess in relation to oxygen, interpreted as metastable*."

Cabral et al. 2002
From the abstract: "*Native Pd, Charactersitically situated in the goethite coating, is intimately associated with a Pd-O phase*."

Cabral et al. 2004
p. 691: "*Hydrogen determined in a Pd-O-H phase is lost during extended analysis, and unstable compared to goethite... This fact would explain why such compound is deficient in oxygen [sic], eventually giving rise, via a deoxygenation-dehydration process, to native Pd*."

Cabral & Kwitko-Ribeiro 2004
p. 684 : "*Rosette-shaped Pd with minor amounts of O, Cu and Fe precipitated directly on the surface of Au...A negative linear correlation between O and Pd...suggests a transitional range from an empirically derived PdO-like stoichiometry to native Pd, where [the latter] would likely be the stable phase of Pd under supergene conditions*."

Cabri et al. 1977
p. 390: *"Genkinite [...] is associated with sperrylite, Pt-Fe-Cu-Ni alloys [...], platarsite [...], ruthenarsenite, stibiopalladinite, mertieite-II, and an unidentified Pt-Pd-Rh oxide in a sample containing silicates and chromite*."
Fig. 1: "*Genkinite with a typical rim of an undetermined oxidation product (darker grey)."* [These oxide observations are not highlighted in the abstract.]

Cabri 1981
p. 87: *"Table 7.3: Recently discredited, doubtful or incompletely characterized species. "Palladinite=mercurian PdO? (Clark et al., 1974.)"*

Cabri et al. 1981
p. 513. Fig. 16. *"Photomicrograph of a prismatic inclusion of osmium nearly completely replaced by the iridium-rich alteration product, in Pt-Fe alloy matrix."* [same picture as Fig. 45t in Cabri et al., 1996].
p. 514: *"In several nuggets some of the osmium laths were partly or completely altered and replaced by a fractured, dark grey, internally reflecting, apparently isotropic phase. Two such altered grains (Figs. 15, 16), both with remnant osmium were analysed (Table III): the low totals-73.60 and 70.23 %- are probably due to O2, H2O, etc. Interestingly, compared to the unaltered areas of the same grains, both altered grains are depleted in Os and enriched in Ir, Pt, Fe, Ru and Rh."* [This observations is high-lighted in the abstract as "an unidentified iridium-rich alteration product"].
p. 516: Fig. 19. *"Photomicrograph of genkinite (mid-grey) rimmed and penetrated by at least two stages of alteration replacement (one of which shows typical shrinkage cracks and is distinctly anisotropic) in a Pt-Fe alloy matrix."* [same picture as Fig. 45r in Cabri et al., 1996].
p. 524: *"Magnetite was located in a number of nuggets in subhedral, angular and rounded grains. Quantitative analysis of the largest grain (Fe 72.0 %) revealed trace amounts of Pt (0.34 wt.%) and Ti (0.08 wt.%)...Further study of the magnetite with the scanning electron microscope did not reveal any*

microinclusions of Pt-rich phases, so it is considered probable that the platinum is part of the magnetite structure..." [This observations is not highlighted in the abstract].

Cabri et al. 1996

From the abstract: *"Important features of the PGM alloys studied include the presence of other PGM (as well as some undefined PGM), PGE-bearing minerals, spinels, silic-ates, and more rarely sulfides...The presence of PGE-oxides and hydroxides (?), all of which are still incompletely characterized, is ascribed to surficial weathering processes."*

p. 111: *"Ethiopia-Birbir River, Joubdo stream: Only genkinite (Fig. 45r) and osmium were altered to secondary minerals, the latter to an unidentified iridium-rich alteration product (Figs. 45s, 45t), which is probably an oxide or hydroxide. This type of alter-ation is unexplained at present."*

Fig. 45r: *"Photomicrograph of genkinite (mid-gray) rimmed and penetrated by at least two stages of alteration replacement (one showing typical shrinkage cracks which is distinctly anisotropic) in Pt-Fe alloy matrix..."*

Fig. 45t: *"Photomicrograph of a prismatic osmium inclusion which is nearly completely replaced by an undefined Ir-rich alteration product."*

p. 100-101: *"Russia, Western Chukot: Within some of the Pt-Fe alloys are 300-μm^2 areas containing vermicular holes, commonly filled with an unidentified Ir oxide of hydroxide (oxygen was confirmed by energy dispersive spectrometry)."* [Table B.32: analyses of Ir-oxide. (Oxygen analysed qualitatively)].

p. 104: Colombia. *"Choco Region, Rio Condoto area: Possible Pt oxides occur as rounded porous grains intergrown with silicates, all within fractures in the Pt-matrix (Fig. 40b, Table B.32); these were previously reported by Weiser (1991)."*

[Fig. 40b: BEI of inclusions of cooperite (light gray) and laths of (Ir,Pt) oxide?)]

[Table B.32: 7 analyses of Pt-Fe oxide, 2 of Ir-Rh-Pt oxide and 5 of Ir-Rh oxide. (Oxygen analysed qualitatively).]

Cabri & Gilles Laflamme 1997

p.100: *"Siliceous Phase: Identification of the siliceous phase (Fig.7) was not possible, despite qualitative analysis performed by EDS which shows Si>Al>Fe±Mg and trace amounts of Ca and K. The material was extracted for X-ray diffraction analysis but proved to be amorphous, although a pattern was obtained and tentatively identified as platinum. The material was therefore mounted on a stub and reexamined by SEM which showed the amorphous crystal filled with micro-inclusions (<I µm) of a Pt-Fe-Cu alloy phase (Fig.8)."*

p.104: *Conclusions: The amorphous siliceous phase found in cavities and depressions of the Pt-Fe alloy crystals, together with intergrown micro-particles (<0.25 µm) of Pt-Fe-Cu alloys (Fig. 7 and 9) [sic] has not been previously reported. Its origin is unknown, but it could conceivably represent a siliceous residue from acid-cleaning of the crystal or chemical treatment of the alluvial ore."*

Chyi 1982

From the abstract: *"The strong [negative] correlation between Pt and Fe and low-temperature ash suggest that Pt may be absorbed and retained as similar colloidal inorganic compounds".*

Clark et al. 1974

p. 531: *"Nearly all the grains [of arsenopalladinite] contain inclusions of subhedral to euhedral hematite, the grain size of which varies from 5 µm to 45 µm. A coating of grey, low-reflecting (of the same order as hematite) mineral, which in crossed polars is strongly anisotropic, is frequently associated with the hematite. This phase also occurs as a superficial coating on the arsenopalladinite grains, which is replaced and penetrated in the form of oriented, parallel, wedge-like plates. ..It is proportionally a minor constituent, the analysis showing it to be a palladium-mercury oxide[1] (approx. 90 % PdO, 10 % HgO)."*

Footnote 1: *"This mineral, still under investigation, is probably a mercurian variety of the hitherto doubtful species palladinite, originally described from Gongo Socco mine, Minas Gerais, by Johnson and Lampadius (1837)."*

Cousins & Kinloch 1976
[Several of the displayed pictures suggest the unacknowledged presence of oxygen-containing crusts and inclusions (Figs. 15C: Birbir Riv., Ethiopia; 18A, 18B, 19A, 19C, 20A and 20B: Discovery, British Columbia, Canada).]
Caption of Fig. 18A: "*Partially encompassed by the zoned [Os-Ir alloys] is a large cluster of decussate and radially arranged laths of iridosmime, the dark interstices of which are osmiridium with a high Fe content. This complexity is difficult to explain*."

Dana 1857
p. 124: *"Palladium Ochre-The palladium ochre, which has still a doubtful existence, is called Palladinite in Shepard's Min., p. 408".*

Dana 1858
p. 14: *"A brown ochreous substance associated with the Palladium Gold of Brazil has been considered as Palladium Ochre or oxyd [sic]. It is soluble in muriatic acid. Detected by Johnson and Lampadius (J. f. pr. Che. xi, 309)."*

Davis et al. 1977
p. M10: *[Inclusions] "of lower reflecting minerals are found in grains 2 and 4 [of palladseite]. Both inclusion phases are isotropic; they occur intergrown together as discrete grains 1-4 µm in size with round cornered, square outlines; the lower reflect-ing grey phase enclose rectangular cores of the higher reflecting phase. They also occur as aggregated clusters of smaller rounded grains (grain size <1µm-2 µm, ag-gregated up to 5 µm) and as subangular wedges, or fingers, penetrating the palladseite grains from its rim, with a maximum length of 8 µm and width of 4 µm. The small size of these inclusions precluded the use of quantitative reflectance and chemical analyses, but qualitative probe scans indicate that both phases are copper-bearing oxides of palladium. As they are isotropic they are unlikely to be palladinite, the only oxide of palladium previously reported."*

Dennis et al. 1994
"New secondary Cu-Pd oxides corresponding to the formulae Cu2PdO3 and Cu5Pd2O7 occur in veinlets of chrysocolla." [See Elvy et al., 1998, for similar results obtained on materials from seemingly the same locality and mines.]

Derricks & Vaes 1956
p. 128: *"The chloritic layer found along the pseudo-dynamometamorphic RSF [Roches Siliceuses Feuilletées] contained a palladium-rich black oxide."*

Distler et al. 1998
p. 187: *"Graphite-like insoluble carbonic matter containing up to 10 ppm Au and PGE".*

Duparc & Tikonowitch 1920
p. 452 (Riv. Kamenka, Urals): *"The platinum that we have seen and collected on the workings was always in small grains, capped by magnetite, and of a black colour.*"
p. 452-453 (Riv. Choumika, Urals): *"The Chumika platinum occurs under three habits, namely:*
1. Crystallized with pyroxene. It has a shiny white colour, with appendices and holes left by vanished pyroxene. The largest nuggets we have seen weighed more than one gram; we own several smaller ones, in which are still inserted pyroxene crystals of absolute freshness.
2. Capped with magnetite, and then of a black colour, similar to that of the Kamenka. This magnetite contains manganese.
3. A much rarer platinum, occurring as small rounded grains, covered with crystalline chromite."

Elvy et al. 1998
p. 35: *"Copper-palladium oxides (Cu,Pd)O. Two Pd-Cu oxide grains were located in a polished block of gossan from the top tip of the Round Hill prospect....Both areas [of grain 1] are heavily pitted, but give quite distinct analyses (Table 2. [Oxygen calculated by stoichiometry]). ...These oxides, if they are not merely admixtures of palladinite and tenorite, CuO, are very copper-rich by comparison to other reported*

(Pd,Cu)O phases from Brazil (Olivo and Gauthier, 1955). If the phases from Round Hill are in fact homogeneous, they should be viewed as being, in the absence of crystallographic data, palladian tenorites." [The results by Dennis et al. (1994) are ignored, although they cross-check some of those presented here for apparently the same Cu-Pd oxides in the same environment and area.]

Eschwege 1833
p. 73, *footnote: *"Ouro podre [rotten gold]: Mr. Döbereiner, Court Counsellor at Jena, to whom I sent a small portion of that gold, analysed it; unfortunately, I lost his result, but I still remember clearly that it contained iron and a little platina."*

Evans 2002
From the SYNOPSIS : "*The PGE in the Main Sulphide Zone [of the Great Dyke, Zimbabwe] occur dominantly in the form of discrete bismuthotelluride, arsenide and sulphide minerals, whereas in the [lateritic] oxidized zone they occur as oxide or hydroxide minerals and aggregates as well as relics of the primary minerals*." [Review of the challenges which will be met with in the forthcoming metallurgy of oxidized PGE ores].

Evans & Spratt 2000
p. 290-291: *"In the trenches, the dominant Pt-bearing mineral is a poorly defined Pt-rich oxide plase [about 2/3 of the total mass of Pt minerals]. Such grains mimic the size, shape and textural position of the PGMs from primary mineralization.... Some Pt oxide grains show euhedral faces within goethite after sulphide....Electron microprobe analyses show that apart from Pt and O, the Pt oxides contain some Fe (1 to 25 wt.%), as well as minor amounts of Cu, Ca, S, Bi, Te and Pd (generally 0.1 to 7 wt.%)....Oxides of Pd and of Ru have also been located, in addition to Pt oxides. These may be intergrown with the Pt oxides, or with sperrylite and braggite. The Pd oxides commonly have traces of Bi and Te, whereas the Ru oxides have traces of Ir and S.... Weathering and oxidation processes are probably very similar over much of the area of the Great Dyke, and it is lokely that discrete PGE oxide phases will be found thoughout the weathered outcrop of the Main Sulphide Zone....Some of the PGE oxide phases from the Great Dyke show shrinkage cracks, and others appear to have a finely porous texture. [p. 292] Such textures are evidence that these grains may be friable or physically weak....The physical weakness and small size of the oxide phases will make it unlikely that physical concentration methods will be effective in their benefication".*

Ferrario et al. 1982
From the Abstract : «*...it would seem that the relatively high Pt values in these rocks are contained in the pyroxenes.* »

Freise 1933
p. 271*: "A larger shipment of the original conglomerate from the Diamantina area allowed for the separation by panning of two types of gold, as a conglomerate component and cement, and as a granular mineral (0.3-0.45 mm) with a dark brown to black, pebbled surface, with a noteworthy density. When treated with dilute hydrochloric acid, this brown surficial material disappears: the grains now appear with a steel-grey, dull surface. A chemical study showed that one was dealing with platinum intergrown with chromite....The brown crust described above, which thickness rarely exceeds 0.1 mm, was found to be an iron humate, precipitated from the humic or black waters, which imported also the conglomerate-cementing gold."*

Fuchs & Rose 1974
p. 73*: "The organic component is highest in importance to the total Pd content of the soil. This component, which is metal that is released in the separation procedure by oxidation, may actually represent Pd tied up in organic material, or it may merely represent Pd in some other form which is easily released by oxidation. The clay component contains the greatest concentration of Pd. It is unkbown whether the Pd actually exists within the clay lattices or whether much of the Pd is in an insoluble form of discrete minerals of small size, which are for some unknown reason insoluble in the extractant [natural solutions of high Eh, low pH and high chloride content]."*
p. 74: *"If the Eh-pH conditions are right, both Fe and Pt may be mobilized. However, on the other side of this boundary, Pt will be fixed. Thus in one sample, most of the Pt was fixed in the silt and iron oxide*

fractions, while in another sample most of the Pt was in a readily-extractable, exchangeable, and organic fraction."

Garuti et al. 1997
p. 1436: "*Recalculated compositions in weight % oxides [of Ru, Os, Ir, Fe, Ni] appear to vary between a stoichiometry of the rutile type,* XO_2*, and one of the hematite type,* X_2O_3".

Garuti & Zaccarini 1997
From the abstract: "*On the basis of the restricted occurrence of these PGM to weathered chromitite, as well as paragenetic and compositional considerations, the secondary assemblage seems to have formed at low temperatures by in situ desulfurization of a PGM sulfide precursor, during serpentinization, followed by oxidation of the desulfurized PGM, under conditions of weathering*." [The table of chemical analyses shows the following oxygenated assemblages or O-enriched zones: Ru-Os-Ir-Fe; Ru-Ni-Fe; Ru-Os-Ir-Cu; Pd-Ru-Os-Ir-Fe. Cr is always attributed to chromite.]
p. 619: "*The oxygen-bearing Ru-Os-Ir-Fe compounds were found exclusively in two samples of weathered chromitite from the mine dump of Agriatses...A number of grains (21) were encountered, but most of them were not readily recognized during initial examination of polished sections because of their relatively low reflectance*." [Pictures of about 10 grains (Fig. 5 and 6) and 23 EMP analyses (Table 5): oxygen was not determined, but totals are low].
p. 623: "*There is some evidence that some of these grains actually consist of submicroscopic associations of native PGE with Fe-hydroxides....There is also evidence that the Ru-Os-Ir-Fe compounds are unstable during low-temperature evolution of the host chromitite...The presence of abundant limonite in this fissure and adjacent to the grain suggests that Fe may have been added by reaction with a circulating aqueous fluid, whereas grain zonation demonstrates that these solutions were able to remove Ir, Pt, and Pd, preferentially; these elements were redistributed in the chromitite alteration-system, thus resulting in a relative increase of the less mobile Ru and Os in the relict PGM*."

Garuti et al., 2002
p. 156: "*The HS technique was applied to 1.3 kg of chromitite and yielded a heavy mineral concentrate containing: (e.g.) 1 (Ru,Fe)-oxide [grain]"*.

Goldenberg 1988
p. 62*: "The analysed platelet of quite pure osmium shows a blueish hue. Its center is obviously dark, nearly black; the cause of this is possibly a thin oxide layer, which is confirmed by a lower brightness on the SEM screeen, compared to the remainder of the grain."*

Gornostayev et al. 2000
p. 553: "*An unidentified Ir oxide or hydroxide …has been found in the rim area of one nugget. The core of this grain is a Pt-Fe alloy close in composition to Pt3Fe, whereas the rim zone, about 300 µm thick, consists of native Pt and is full of vermicular holes filled with Ir oxide or hydroxide*."

Guimaraes 1958
p. 18: "*The black colour [of some of the mamillary platinum fragments from Fazenda Limeira] is surficial, and probably due to an oxide of manganese and iron*." [No analysis].

Hess 1926
p. 130-131: *"Empire N°1 Claim=Schnitzler Tunnel: "The few inches of iron- stained chlorite schist that surrounded the small sulphide mass was reported to carry a considerable quantity of the platinum metals. Accordingly, a sample of the rustiest part was collected and assayed. The assay showed: (troy ounces / short ton): Pt 0.12, Ir 0.07, Pd none...About 55 feet beyond the occurrence just described a second fracture about parallel with tthe first crossed the drift...A foot beyond this place there occurred 4 inches of crushed schist, 1 inch of gouge, and 8 inches of iron-stained chlorite schist. An assay of a sample cut across this material gave a button equivalent to 0.11 ounce to the ton. Small amounts of Ag, Pt and Pd were identified, but no test was made for Ir, as the entire button was so small."*

Hey 1999
p. 258: *"Back-scattered electron images generated on the SEM clearly show that in the vicinity of some of the optically observed PGM, the host silicate is of brighter appearance than would be expected, that is, it has a higher average atomic mass than the surrounding silicates and chromites. Analyses of the 'brighter silicate' revealed significant amounts of PGE. Detailed descriptions and photomicrographs of such phases are given in Figures 15 to 18 and Tables 8 and 9."*
Table 8 and p. 258: *Six EMP-analyses of silicates with high BS-yield. "The analyses show the elevated Pd and lesser Rh contents of these phases and also significant copper content."*
p. 258-259: *"Figures 19 and 20 show the presence of two particles which contain significant base metals [Cu, Ni, Fe, Co, Mn] in addition to the PGE. These could be considered as true PGE 'oxides/hydroxides'. Analyses of the phases are given in Table 9. From these results it can be seen that in Figure 19 the phase analysed is likely to be a palladium-copper-iron oxide/hydroxide. In Figure 20 the phase analysed is a complex manganese-nickel-copper oxide with areas of high PGE. It is assumed that the PGE are present as oxides. Figure 21 shows a complex particle of braggite and laurite. The braggite can be seen to be partially altered to a PGE-oxide, whilst the laurite appears to be altering to a Ru-Rh-Mn 'oxide'".*
p. 259: [Discussion of the possibilities for the mobilization of the PGE, cf. Wood et al., 1992, as humic and fulvic acids which are likely to play a role in the movement of PGE in the surficial environment. These conditions are especially relevant to the black, acid turfs overlying the Bushveld Complex. Salts accumulating during a dry season of six months, followed by heavy rains, are also to be taken in consideration.]

Hussak 1906
p. 292: "*This palladian gold [from Itabira do Matto Dentro] is not rarely covered with a brown earthy, limonitic crust, which proved to be palladium oxide (PdO= palladinite), according to Lampadius. It is easily soluble in hydrochloric acid and yields the characteristical microchemical reactions of Pd*."

Iimori & Yoshimura 1929
Abstr. in Miner. Abstr.: *"X-ray absorption spectra and arc spectra indicate the presence of ruthenium and rhodium, and it is believed that the pink colour of the kaolin is due to these trace elements."* [According to the original paper, ruthenium has also been found by the rhodanate colour reaction on the hydrogen sulfide heavy metal precipitate extract-ed from the acid solution. The observation is intriguing, although the other more common minor elements found in the kaolin would be largely sufficient to impart a pink colour: Fe2O3=1.69 wt.%, FeO=0.26, MnO=0.39].

Jedwab 1992
p. 159: [Potarite showing featherlike or dendritic habits is comformably deposited in the middle of iron hydroxide fingers affecting a pyrite nodule (Figs. 4 and 5). Local chemical differences of this potarite are observed for gold (up to 3.3 wt. %), thallium (33.2 %) and iodine (3.1%). This potarite is associated with acanthite, suggesting a low temper-ature formation.]

Jedwab et al. 1992
p. 690 and Fig. 5: *"Alteration minerals affect the secondary, cracked cupriferous rinds of many Pt grains, and luberoite inclusions: kaolinite, chlorite/biotite, anatase, Ba-REE and Al-REE phosphates (gorceixite and florencite)."*

Jedwab et al. 1993
Abstract : « *Palladinite has been positively determined in Itabira and Ruwe samples by chemical composition, crystal structure, light reflectivity and hardness.The formation of palladinite results from the oxidation of arsenopalladinite and isomertieite at Itab-ira, of palladseite at Itabira, and of oosterboschite at Ruwe".*

Jedwab 1994
Abstract : *" Pt, Pd, Ru and Ir are present in heterogenite in concentrations of up to 5 wt. % each, without particles larger than 0.05 µm being visible."*