

A bibliographic guide to Unconventional Platinum Group Minerals and Mineraloids (UPGMM)

The present work is an attempt to help those who want an overview of the rapidly expanding topic of “Unconventional Platinum Group Minerals and Mineraloids” (UPGMM). Three parts are presented here as a beginning: a set of Tables of the recorded compounds, a list of the relevant references, and excerpts from the original texts (translated when appropriate). Later additions will include “Localities”, “Properties”, “Nomenclature”, etc.

Although the topic has a history beginning three centuries ago, it is only since the introduction of the electron microprobe (EMP) around 1960 that some light could be shed on this rather complicated and improbable topic. Since then, publications have piled up at an increasing rate, especially since 2000.

The UPGMM group is heterogeneous by definition. A heuristic definition could be worded as follows: “A group of natural compounds containing Platinum Group Elements (PGE) which are not native metals, intermetallics, alloys, sulfides, selenides, tellurides, arsenides, antimonates, bismuthates, and sulfosalts”. The rationale behind this negative definition is that whereas the last cited (reduced) compounds are long recognized as legitimate, the UPGMM are still awaiting some consensual recognition because the PGM have “always” been considered as impervious to chemical alteration.

As a first approximation, the definition covers the oxygen-containing PGE-compounds, but some pigeon holes should be provided for seemingly rare carbonaceous and halogenated compounds. Due to the frequent association in various proportions of the six PGE (Pd, Ru, Rh, Os, Ir, Pt), one ends up with 13 sub-groups if one tries to put some order among the numerous compounds which have already been recorded.

The main body of the present Guide consists of a set of TABLES in which the UPGMM have been entered according to their main chemical/mineralogical compositions. The entries in each table are arranged in chronological order. Multi-element compounds are often difficult to assign to a precise group, or even to a TABLE, since the original analyses are frequently qualitative or semi-quantitative, when not merely described under more or less precise chemical names. Accepted mineralogical names are still extremely rare (cf. “palladinite”). Details in the TABLES have been kept minimal, with only the name(s) and year of the references, and the country of specimen origin. More details are often found in the full titles of the bibliographical list.

In column “#” is indicated by Yes or No if an excerpt and/or a note is to be found in the corresponding section. In the column “P” is indicated by Yes or No if a UPGMM picture is to be found in the quoted paper.

In the “EXCERPTS and NOTES” section, one finds relevant quotations of old and recent texts. NOTES between [brackets] are used as a means of commenting or summarizing some statements by the present author, or highlighting some hidden conclusions.

It is obvious that the present endeavour will never be completed, for several reasons:

- Valuable (but overlooked) observations will again and again be discovered in old texts (cf. “black crusts”).
- Past observations and mineralogical determinations will need a re-assessment in the light of modern EMP-analyses, and will need to be corrected.
- There are recent observations aided by all the electronic gear, but which have overlooked the reflected light properties, or/and the presence of oxygen, water, hydroxyl: they will also demand some corrective conclusions. The skepticism which prevailed until about 2000 will not die out at once.

-It is foreseeable that in the near future, several UPG-Minerals and -Mineraloids will be resolved into several sub-micrometric phases (nanometric) and thus, several of the compounds, or even groups, will need realignment.

The UPGMM topic is now booming, according to the following figures:

1800-1850: 7 references
 1851-1900: 4 “
 1901-1950: 13 “
 1951-1983: 21 “
 1984-2000: 56 “
 2001-2004: 13 “

The last decade progresses in PGM ore geology, prospecting and mineralogy, and in PGE mining are of course instrumental in this explosion of findings and publications. As well as the introduction of the SEM/EMP was the methodological means of proving the reality of UPGMM, the UPGMM exploration at the nanometric scale, which looms large, will need even rarer gear, and will be an exciting and shaking one.

More UPGMM pictures are presented in the following web-sites:

www.ulb.ac.be/sciences/upgm
www.ulb.ac.be/sciences/katangapgm
www.ulb.ac.be/sciences/uralirite/uralirite.pdf

LIST OF CHEMICAL-MINERALOGICAL TABLES

- 1-Native PGE, alloys, sulfides, etc. (primary, with incipient oxidation evidenced by incompatible elements, or secondary after oxide reduction)
- 2-Simple Pd-dominant (oxi)(hydr)oxides
- 3-Simple Pt-dominant (oxi)(hydr)oxides
- 4a-Complex Pd-(Pt-Ru,Rh,Os,Ir) (oxi)(hydr)oxides
- 4b-Complex Pt-(Pd-Ru,Rh,Os,Ir) (oxi)(hydr)oxides
- 5-Simple Ru-Os-Ir-(Rh,Pt,Pd) (oxi)(hydr)oxides
- 6-Complex Ru-Rh-(Os,Ir,Pd,Pt)-(oxi)(hydr)oxides
- 7-Complex Ir-Os-(Ru,Rh,Pd,Pt)-(oxi)(hydr)oxides
- 8-PGE (oxi)(ammonio)-chlorides
- 9-PGE-containing silica and silicates
- 10-PGE-containing sulfates and carbonates
- 11-PGE carbides, carbonaceous compounds, and organometallics
- 12-Black Crusts
- 13-Miscellaneous

