

Looking for Needles in a Haystack: How to Find PGM in Laterites by Using Hydroseparation Techniques

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INTRODUCTION.

Taking their great potential as future ore resources into account, surprisingly few detailed studies on Platinum Group Minerals (PGM) found within supergene environments have been done. In particular, our current knowledge of PGM in laterites that overlie mafic to ultramafic bodies in tropically weathered regions is mainly based on the works of Augé (1994), Bowles (1986), McDonald (1999) and Salpeteur (1995).

One possible explanation for the lack of further investigations in this field could be the fact that sample preparation is highly time consuming with very limited chances to find PGM by using traditional concentration techniques such as panning. Generally low total PGE contents of laterite samples combined with usually very small grain sizes of PGM (<40 µm) are the main challenges when trying to find PGM in laterites.

In this work we present the innovative hydroseparation technique HS 11 (developed by CNT-MC Inc., St. Petersburg) which was recently installed in the HS 11 laboratory at the University of Barcelona, by demonstrating the complete separation procedure for PGE-bearing laterite samples from the Dominican Republic. Because of its unique advantages when it comes to very small grain sizes, this non-chemical concentration technique will certainly play a key role in future laterite linked PGM investigation.

LATERITE SAMPLE PREPARATION FOR HS 11.

The very sensitive HS 11 hydroseparation technique permits sample processing of small quantities. Therefore preconcentration methods like ultra-sonic treatment are used to avoid

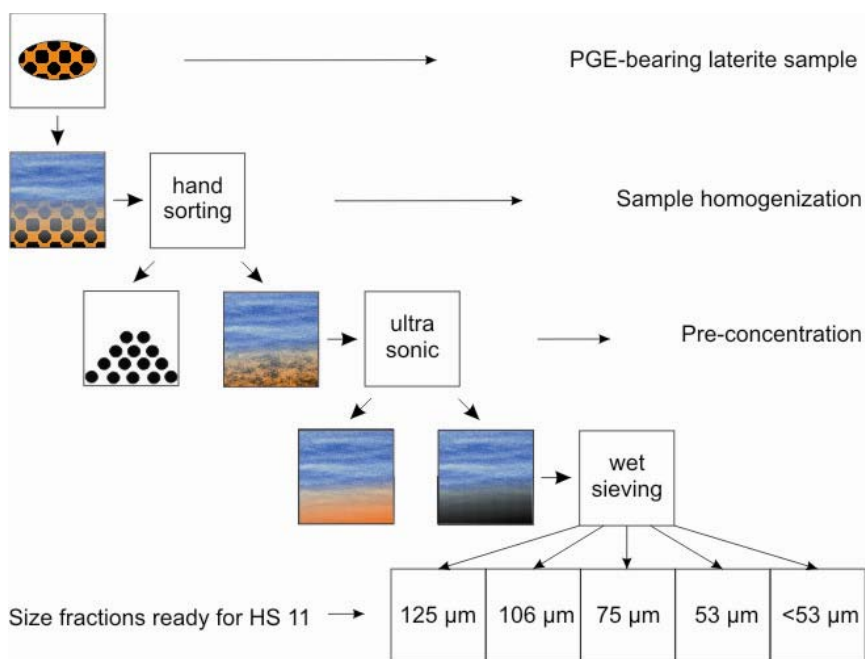


fig 1. Flowsheet explaining the necessary steps for laterite sample preparation before HS 11 hydroseparation processing.

extended separation periods. As grain size effects are critical for the success of heavy mineral concentration the laterite sample has to be homogenized by hand and finally wet sieved. An overview of necessary laterite sample preparation before HS 11 hydroseparation is given in fig. 1.

THE HS 11 LABORATORY.

The HS 11 system consists of the following components (fig 2.):

- Elevated water tank providing laminar gravity flow with constant pressure.
- Flowmeter with a range of 30 - 300 ml/min for flow regulation.
- HS 11 device connected to a computer with HS 11 software for impulse control.
- Glass-Separation-Tubes (GST) of

different lengths and diameters for mineral separation process.



fig 2. HS 11 system at the University of Barcelona; A: water tank for gravity flow out of sight; B: flowmeters; C: HS11 device with connected laptop; D: Glass-Separation-Tube (GST).

HYDROSEPARATION BY HS 11.

An amount of 10-20 g of sample suspension is loaded into the GST and

the initial water flow (30-50 ml/min) is set. As soon as the impulse regime is turned on the separation process starts and less dense grains are leaving the GST as shown in fig. 3. Heavy minerals are concentrated at the bottom of the GST.

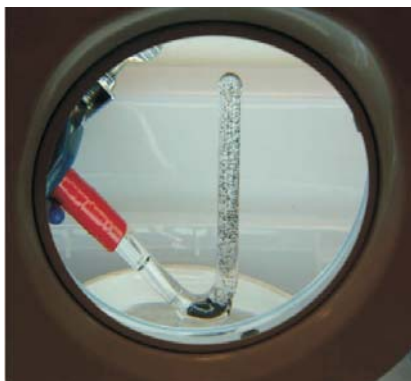


fig 3. Close-up of a 10 cm long GST during separation process. Note the ascent of less dense mineral phases.

The hydroseparation process is continued with different HS parameters (flow rate, impulse regime, processing time, etc.) until a representative final concentrate is achieved. The end products are closely-packed monolayer polished sections of the final concentrate, which can be easily analyzed by SEM-EDS and microprobe (fig. 4).



fig 4. Closely-packed monolayer polished section of final concentrate; diameter = 2.5 cm.

RESULTS AND DISCUSSION.

Two laterite samples (limonitic horizon) from the Falcondo Ni-laterite deposit (Dominican Republic) with total PGE contents of approximately 200 ppb have been processed by the described method. In each sample PGM could be found.

One sample was collected within a chromitite bearing laterite profile, whereas the laterite profile of the

second sample is chromitite free.

The detected PGM are all smaller than 30 µm and mainly consist of Os-Ir-Ni-Fe and Pt-Ni-Fe phases. According to their occurrence they can be classified into two groups:

- Liberated or free grains of PGM (fig. 5), which have porous (spongy) surfaces and show irregular zonation textures.
- PGM grains included in other mineral phases like progressively weathered awaruite or chromite grains (fig. 6).

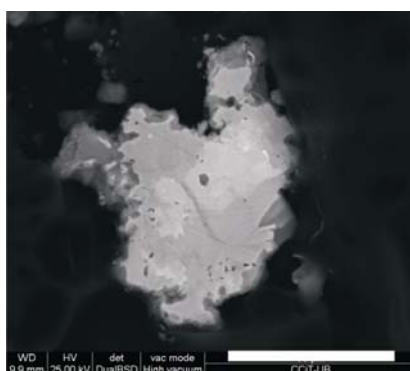


fig 5. Liberated or free grain of PGM with Pt, Ni, Fe. Scale bar = 30 µm

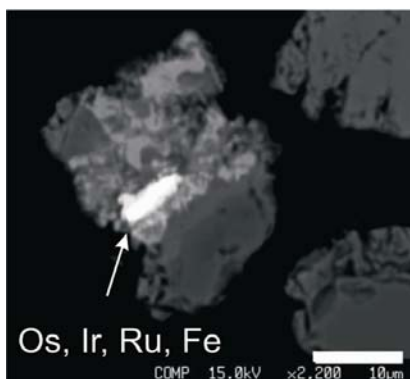


fig 6. PGM (Os, Ir, Ru, Fe) included in Awaruite. Scale bar = 10 µm

In general PGE enrichment of laterites is believed to be controlled by the presence of chromitite. However, PGM grains were also found within the chromitite-free laterite profile. In fact, PGE concentrations in the studied limonitic horizons are quite high compared with mantle peridotites not affected by lateritization. Therefore, supergene processes may influence the re-distribution of PGE, producing local enrichment in these elements.

According to their texture and mode of occurrence included PGM seem to have a primary origin. Hydrolysis processes

could have led to chromite dissolution and therefore to liberation of these PGM grains (Proenza et al., 2010).

However, the fact that free grains of PGM were also found within the limonitic horizon of a chromitite free laterite profile raises the question, if these PGM are intrinsically the residue of a primary enrichment, or, if PGE enrichment during lateritization processes could have been sufficient to form secondary PGM phases as proposed by Bowles (1986).

Finally, our results indicate that HS 11 hydroseparation technique has proved to be very effective to concentrate PGM in laterite samples.

ACKNOWLEDGEMENTS.

We thank Louis Cabri and Vladimir Rudashevsky from CNT-MC Inc. for their continuous assistance during installation of our HS-11 laboratory. The University Centrum for Applied Geosciences (UCAG) is thanked for the access to the E. F. Stumpfl electron microprobe laboratory. This research has been financially supported by the Spanish project CGL2009-10924. The authors gratefully acknowledge the help and hospitality extended by the staff of Falcondo mine (XSTRATA).

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