New data on the specular reflectance of ores (VNIR: 400 - 1000nm) and their significance for ore microscopy

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This work is part of the project *CAMEVA* for the development of an expert system aimed at the automatic identification of ores [1, 2]. It relies on the measure of their reflectance values, **R**, on digital images. Software for calibration, acquisition and analysis of the multispectral data was designed by *AITEMIN* [3]; the research was also assessed by H.J. Bernhardt and E. Pirard [1].

The work deals with the first stage in the development of the system: the creation of a reference data base, **DB**, including multispectral reflectance values of the most important ore minerals in the *VNIR* realm [4, 5]. A most delicate step is the selection of the ores and fields to be measured, implying a previous and very careful study of the samples. A poor quality of the polished surface or an ill-defined mineralogy would invalidate the results. The samples studied belong essentially to the collections of the Madrid School of Mines, and to the well-known Rehwald / Ramdohr collection of ores.

The DB, still to be completed, allows some insights [6] into the behaviour of the common ore minerals beyond the visible spectrum (Fig.1). The change in the slope of some spectral curves entering the IR realm is very remarkable, as is the case with pentlandite and niccolite, whose R exceeds that of pyrite, marcasite and arsenopyrite in IR. The same contrast is seen in the *VNIR* behaviour of couples like pyrrhotite – chalcopyrite, pyrrhotite – galena and cubanite – galena. On the other hand, the spectral curves of pyrrhotite and cubanite, very close in the visible realm, are diverging in IR.

Furthermore, it is important to note that on entering the IR realm some minerals, as tetrahedrite, hematite, and magnetite, show a sensible decrease in their reflectance values, while others like covellite and bornite undergo a dramatic increase.

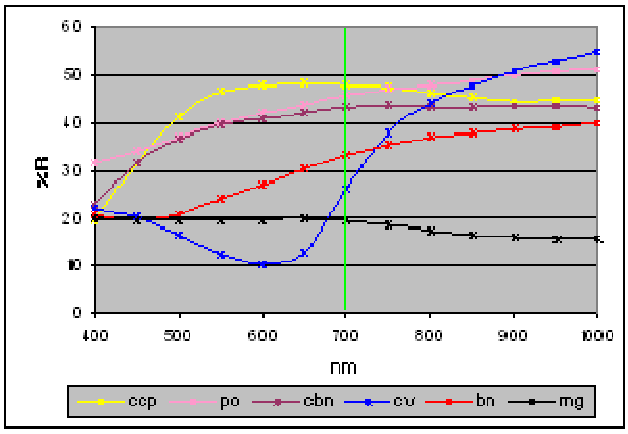

Fig. 1: Reflectance curves of chalcopyrite (ccp), pyrrhotite (po), cubanite (cbn), covellite (cv), bornite (bn) and magnetite (mg).

The DB is consistent with published values in the visible realm [7: values 400 – 700 nm], and shows that the new information in the near IR (700-1000 nm) may be of high diagnostic value.

[1] Castroviejo, R. et al (2010) *This vol.* [2] Castroviejo, R. et al (2009) 10th Biennial Meet. SGA, Townsville, QLD [3] Catalina, J. et al (2008) Proc. Symp. Min. Apl. Geomet, abs. R3, XIII Congr. Lat. Geol., Lima [4] Pirard E. (2004) *Mineral. Mag.* 68 (2), 323-333. [5] Pirard E. et al. (2008) 9th *Int. Congr. Appl. Mineralogy*, Brisbane, 1-6. [6] Brea, C. (2009) MSc Thesis, UPM, Madrid [7] Criddle, A. & Stanley, C. (1993) QDF 3rd edition, Chapman & Hall, London, 635p.