**CHEMICAL ANALYSIS OF IRON METEORITES USING A HAND-HELD X-RAY FLUORESCENCE SPECTROMETER.**

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**Introduction:** The XRF technique has been widely used for the bulk chemical analysis of meteorites since the late 1960s and early 1970s [1] . More recently, Hand-Held X-Ray Fluorescence Spectrometers (HHXRF) was used for the first time to identify and classify different groups of stony meteorites, and to quantify their terrestrial elemental contamination [2] . The reasons for the significant success of HHXRF [3] include (i) portability of the instrument, (ii) the easy handling of the operating system, (iii) minimal sample preparation (iv) rapid, non-destructive field analyses with remarkable reproducibility and low detection limits for elements heavier than Mg. In this work we tested a commercial HHXRF instrument for its suitability in the bulk chemical analyses of iron meteorites, encouraged by the fact that HHXRF was mainly designed for the metallurgical and mining industry, especially for the analysis of metal alloys.

**Methodology:** The instrument used in this study was a NITON XL3t GOLDD+ XRF spectrometer (50 kV, 200 µA, 2W). Analytical precision and accuracy were tested on metal alloy certified reference materials and iron meteorites of known chemical composition. With minimal sample preparation (i.e., flat or roughly polished surfaces), HHXRF allowed the precise and accurate determination of most elements heavier than Mg, with concentrations greater than 0.01% m/m in metal alloy CRMs, and of major elements Fe and Ni and minor elements Co, P and S (generally ranging from 0.1 to 1% m/m) in iron meteorites. In addition, multiple HHXRF spot (diameter: 3 and 8 mm) analyses could be used to determine the bulk chemical composition of iron meteorites, which are often characterised by relatively large and scattered sulfide and phosphide accessory minerals. In particular, it was possible to estimate the P and S bulk contents, which are of critical importance for the petrogenesis and evolution of Fe-Ni rich liquids and iron meteorites.

**Results:** This study validates HHXRF as a valuable tool for use in meteoritics, allowing the rapid, non-destructive (1) identification of the extraterrestrial origin of metallic objects (i.e., archaeological artefacts); (2) preliminary chemical classification of iron meteorites; (3) identification of mislabelled/unlabelled specimens in museums and private collections and (4) bulk analysis of iron meteorites.

**References:** [1] Reed S.J.B. 1972 *Meteoritics* 7:257–262. [2] Zurfluh F.J. et al. 2011 *X-Ray Spectrometry*, 40:449–463. [3] Potts P.J. and West M. 2008 Portable X-ray fluorescence spectrometry – capabilities for in situ analysis. *Royal Society of Chemistry Publishing (Cambridge, UK)*, 291pp.

**Acknowledgements:** Programma Nazionale delle Ricerche in Antartide (PNRA) PEA 2013, Meteoriti Antartiche. Ministero Affari Esteri AE - PGR PGR00107.