ESRF	**Experiment title:** REE rich minerals in a unique Martian breccia – a non-destructive submicron-XRF study	**Experiment number**: ES 845
Beamline: ID 16 B	**Date of experiment**: from: 15/11/2018 to: 19/11/2018	**Date of report**: 28/1/2019
Shifts: 12	**Local contact(s)**: Jussi-petteri Suuronen	*Received at ESRF:*

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Report:

Martian meteorites represent an important source of detailed petrological and geochemical information. About 200 meteorites classified as Martian meteorites of various rock types are known today [1]. These socalled SNC – meteorites are a unique group of magmatic rocks originally formed on Mars and separated from their source planet through a series of large asteroid impacts on the planetary surface. Their relation to Mars is confirmed via oxygen isotopic data [2,3], trapped atmospheric gas [2], a similar trend in Mn-Fe ratios in olivine and pyroxene [2,3] and more recently due to comparison with chemical measurements of rover missions on the surface of planet Mars [4]. One of the scientifically most valuable find of a Martian meteorite within the last decade is sample NWA 7034 and related pairings (like NWA 8171) or better known with its synonym "Black Beauty" [5].

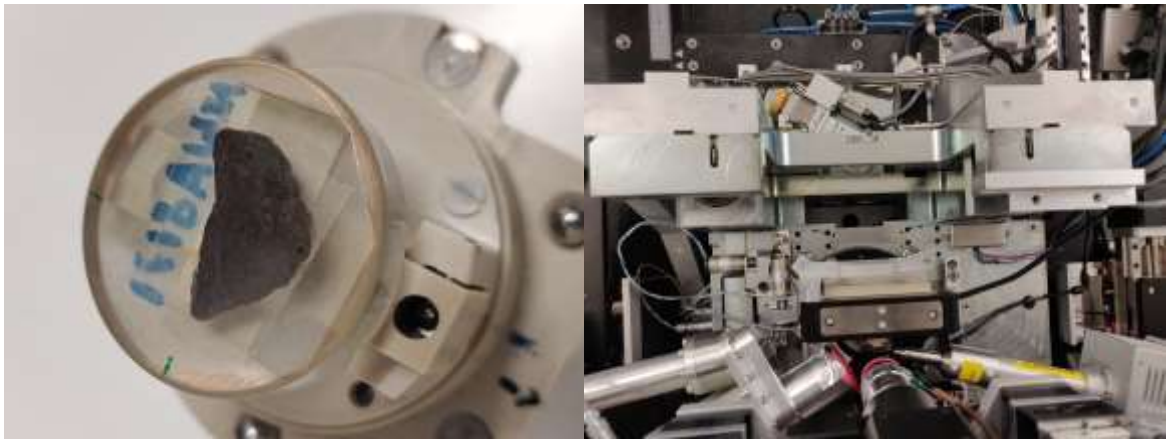

Figure 1. Left: NWA8171 thin slice in epoxy mount Right: Confoca nano-XRF setup at ID16B beamline.

During this experiment a polycapillary optics (XOS Inc., Albany, USA) based confocal setup was applied to image different parts of interest in the Martian Brecca. In figure 2 the obtained elemental composition of a detail of the main granite ROI can be observed. This part has been clustered and the clusteres of interest will be quantified using a fundamental parameter based quantification method.

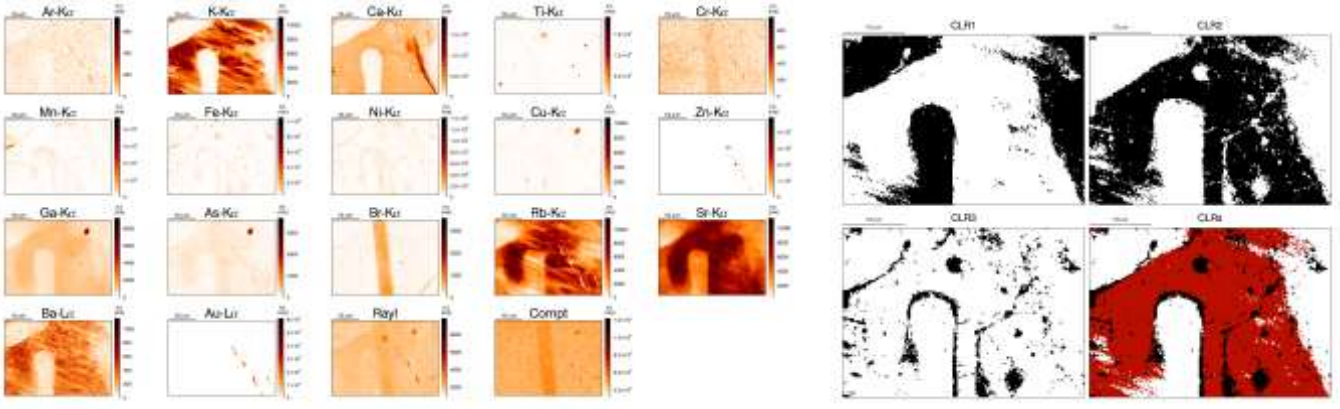

Figure 2. Left: Result of a confocal nano-XRF elemental mapping with a 200 nm beam resolution Right:Results of the clustere analyses performed on the elemental mappings. The elements of interest are K and Rb.

The obtained data will be cross references with previously measured SIMS data and will allow to identify important processes associated with the formation of the Martian crust. As the meteoritic breccia represent the only Martian crustal rock available for study in Laboratories on Earth, the detailed study of this granitic subgroup will help to better understand the conditions and chemical variability on the ancient surface of planet Mars.

[1] Grossmann, J. (2017) Meteoritical Bulletin Database, update 4th September 2017.
[2] Treiman, A.H., Gleason, J.D. and Bogard, D.D. (2000) The SNC meteorites are from Mars. Planet. Space Sci. 48, 1213-1230.
[3] McSween, H.Y. Jr. (2015) Petrology on Mars. American Mineralogist 100, pages 2380–2395.
[4] Sautter, V. et al. (2015) In situ evidence for continental crust on early Mars. Nature Geoscience 8, 605-609.
[5] Agee, C.B. et al. (2013) Unique meteorite from early Amazonian Mars: water-rich basaltic breccia Nortwest Africa 7034. Science 339, 780-785.