Europlanet TA Scientific Report

PROJECT LEADER

Project number: 20-EPN-031
Name: Dr Rhian Jones
Home Institution: The University of Manchester
TA Facility visited: CRPG, University of Lorraine, Nancy, France.

Project Title:

Scientific Report Summary.
(plain text, no figures, maximum 250 words, to be included in database and published)

We have measured the concentration of halogens in the glasses of chondrules from enstatite chondrites. There is a clear correlation between Chlorine and Bromine abundances, but no clear relationship between Cl or Br and F. Iodine was not measured. In the main S is well correlated with Cl: this trend may have been modified by unintended analysis of micron scale blebs on sulphide. Halogen profiles have been taken across a number of suitable target chondrules, for diffusion modelling, which will be presented and published in due course.

The array of data for F/Cl is sub-chondritic while the Br/Cl array is super-chondritic. Evaporation and condensation may play important roles in controlling halogen behaviour, along with partitioning between other significant reservoirs in chondrites because fluorine is likely to be compatible in a number of silicate minerals. More will be known after diffusion modelling and after the experimental partition coefficients have been determined.

Full Scientific Report on the outcome of your TNA visit

Travel Details

Edward Baker travelled from Manchester to London and on to Nancy by train. The outward day of travel was the 11th of December, arriving at about 6 pm. The hotel was the Hotel Ibis, Nancy. Edward planned to return to the UK on the 18th of December but instead returned on the 17th due to the worsening COVID situation in both the UK and France.

Edward Baker is a Postdoctoral Research Assistant, working with Dr Rhian Jones.

Summary of Scientific Methods

The principal scientific method was Secondary Ion Mass Spectrometry, SIMS. The chondrites were chosen and glasses were analysed by electron microprobe in the UK prior to the SIMS visit, including analysis of Cl. This allowed targets to be chosen for SIMS analysis. We were not able to measure iodine because the iodine peak was not reliably found by the SIMS instrument. An estimate was made, however upon inspection of the data this was found to be incorrect.

Finding the correct locations on the natural sample was challenging due to the low quality of the photos and the small field of view. This problem was solved using the optical microscope in Nancy.

While data was collected from several chondrules, some chondrules, particularly those in LAR12252 and LAR 12156, have a considerable amount of high and low halogen enriched glass, suitable for SIMS. The principal problem for the other samples was the small size of the glass/mesostasis areas.

Summary of Results

We have measured the concentrations of halogens in the chondrule glass of enstatite chondrites. There is a strong correlation between the Cl and Br concentrations. The Cl/F trend is quite flat, with only a small range of F concentrations from 1355-135ppm. Sulphur varies from 280-41415 ppm with all the highest concentrations found in LAR 12252; some of the sulphur array is well correlated with chlorine. Chlorine (38-23943 ppm) and bromine (bdl – 401 ppm) are well correlated with the highest concentrations found in the LAR 12252 chondrules.

- Give details of any publications arising/planned (include conference abstracts etc)

Baker E., Jones R. H. and Villeneuve J. (2022) Source of halogen elements in chondrules from enstatite chondrites. 3rd British Planetary Science Conference.

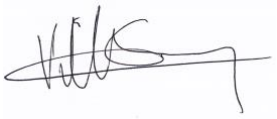
Baker E., Jones R. H. and Villeneuve J. (2022) Halogen Evolution in the Early Solar System: diffusion of halogens during chondrule formation. 85th Meteoritical Society Meeting, Abstract #6354.

- Host confirmation

Please can hosts fill in/check this table confirming the breakdown of time for this TA project:

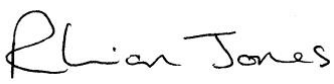
Dates for travel to accommodation for TA visit (if physical visit by applicant)	Start Date of TA project at facility	Number of lab/field days spent on TA Visit pre-analytical preparation	Number of days in lab/field site for TA Visit	Number of days spent in lab for TA Visit data analysis	End Date of TA project at facility	Dates for travel home (if physical visit by applicant)
Departed: 11/12/2021 Arrived: 11/12/2021	13/12/2021	0	5	0	17/12/2021	Departed: 17/12/2021 Arrived: 17/12/2021

The host is required to approve the report agreeing it is an accurate account of the research performed.

Host Name	
Host Signature	**Johan Villeneuve, lab manager of IPF CRPG platform**  **Laurie Reisberg, CRPG Europlanet coordinator** 
Date	**13 May 2022**

- Project Leader confirmation

Do you give permission for the full version of this TA Scientific Report (in addition to the 250 word summary) to be published by Europlanet 2024 RI on its website and/or public reports? YES

Project Leader Name	Rhian Jones
Project Leader Signature	
Date	09/09/2022

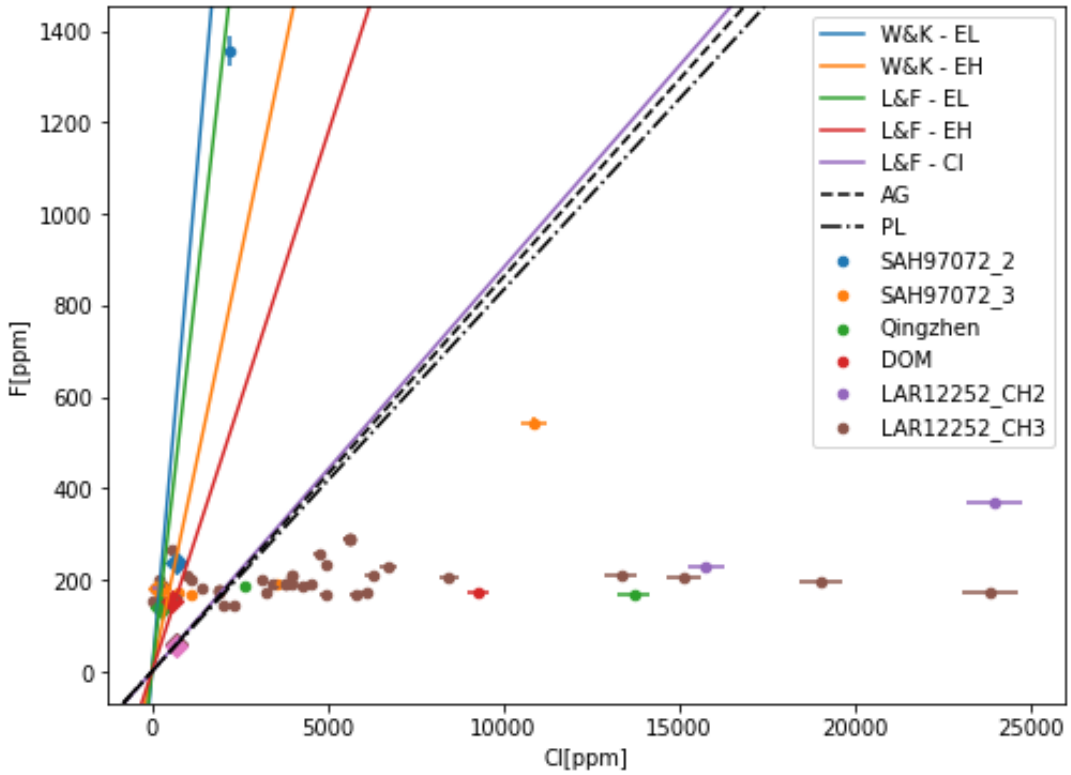


Figure 1: Figure of Chlorine and Fluorine concentration in glasses found in enstatite chondrites; DOM 14021, SAH 97072, Qingzhen, LAR 12252. Error bars are 1 sigma. Graph shows that while the Cl concentration varies significantly the Fluorine concentration varies much less. W&K = Wasson and Kallemeyn 1988, L&F = Lodders and Fegley 1998. EH, EL and CI refer to the classes of chondrites. AG and Pl refer to bulk solar system ratios; AG = Anders and Grevesse 1989, PL = Palme H, Lodders K, Jones A (2014).

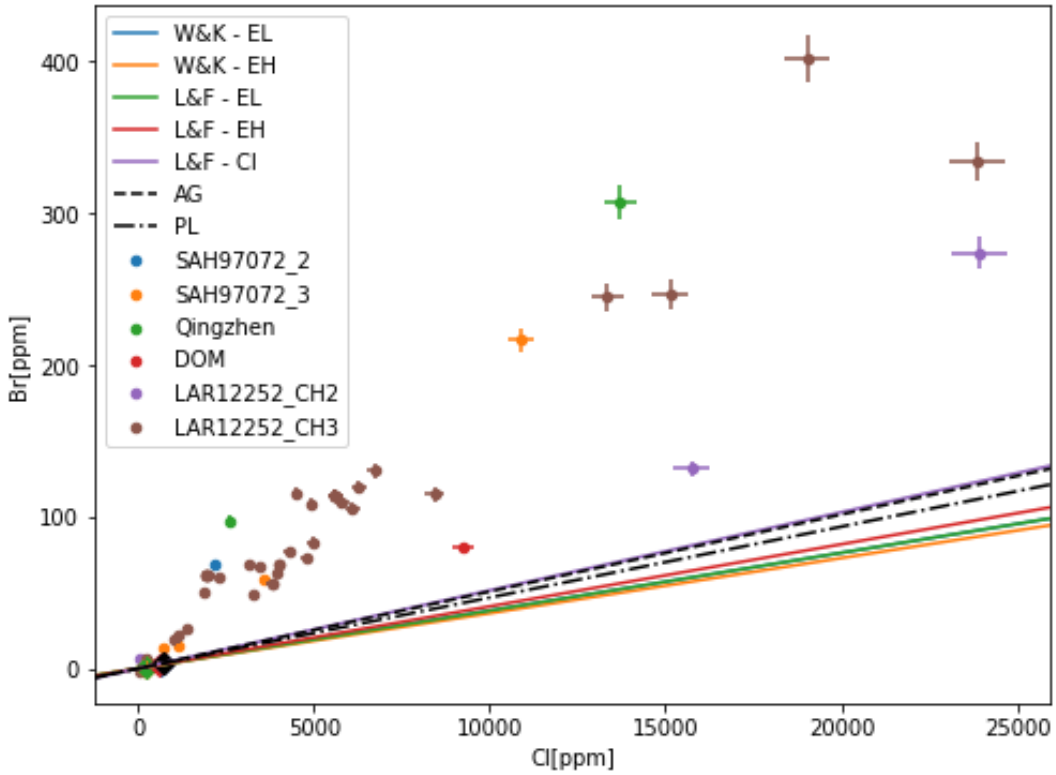


Figure 2: Figure of Chlorine and Bromine concentration in enstatite chondrite glasses. Enstatite chondrites measured were, DOM 14021, SAH 97072, Qingzhen, LAR 12252. A strong and clear correlation is found between the Chlorine and Bromine concentrations. W&K = Wasson and Kallemeyn 1988, L&F = Lodders and Fegley 1998. EH, EL and CI refer to the classes of chondrites. AG and Pl refer to bulk solar system ratios; AG = Anders and Grevesse 1989, PL = Palme H, Lodders K, Jones A (2014). Clay 2017 (red area).

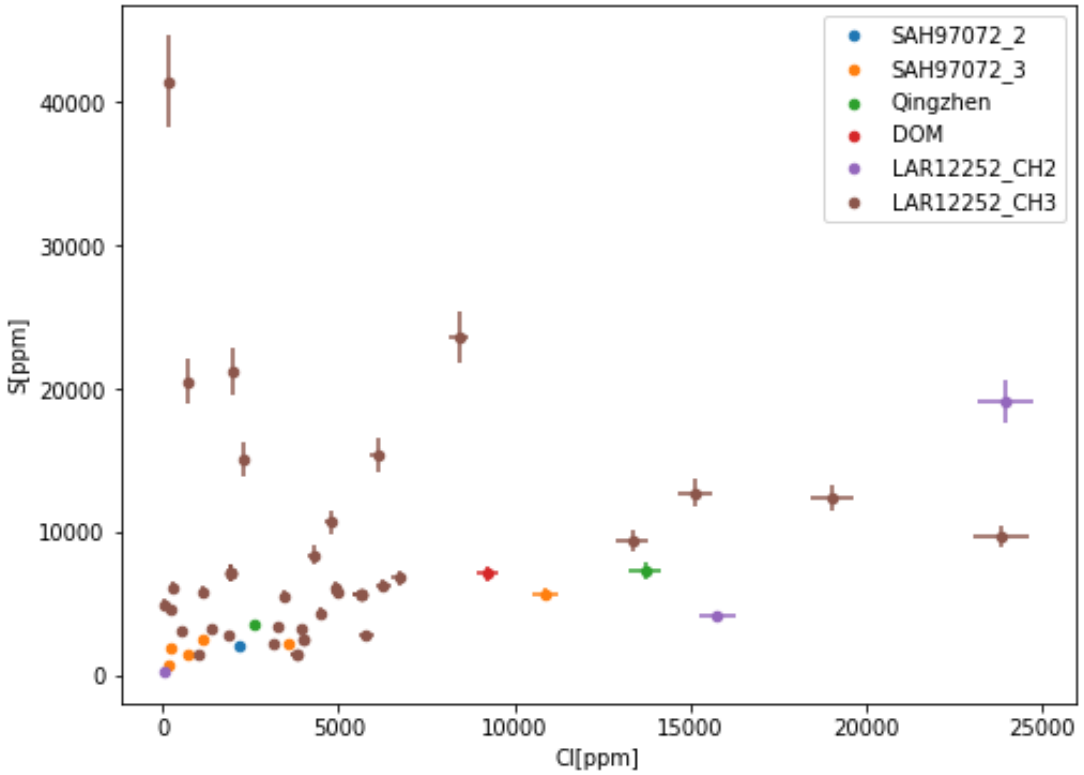


Figure 3: Plot of the Chlorine and Sulphur concentration in Enstatite chondrites; DOM 14021, SAH 97072, Qingzhen, LAR 12252. Some correlation can be seen between Cl and S, however some points from CH3 in LAR 12252 have unusually high S contents, up to 4 wt.%, these points may have been contaminated by Sulphide blebs contained in the chondrite glass.