AMUNDSEN

Antarctic Meteorites cUratioN, Digitalization and conSErvatioN

Contract - BR/154/A6/AMUNDSEN

Summary

Context

Over the last years, joint Belgian-Japanese missions in Antarctica (VUB-ULB, SAMBA project) have recovered more than 1200 pristine and unique meteorite samples. The arrival of these new samples strongly stimulates the curation of meteorite collections in Belgium, supported by the BELAM project (RBINS-VUB-ULB, 2012-2019, funded by BELSPO). Following the new regulation procedure for sample conservation that are implemented at the RBINS in the frame of the ISO9001 norm, the AMUNDSEN project provides a roadmap for conserving and studying extra-terrestrial samples in the best conditions possible. More specifically, the ISO9001 regulation requires two types of conservation, the preventive and the preservative that both need to be addressed for obtaining the certificate. Consequently, this project directly confronts the most troubling problem of the meteorite conservation, experienced by museum worldwide: the rapid alteration of the meteorite surface, which is already observed in some of the RBINS specimens, despite their recent recovery from Antarctica.

Objectives

The AMUNDSEN project is dedicated to the conservation, classification, valorisation and digitalization of meteorites at the RBINS with the goal to improve the maintenance of this fragile collection, develop best practice meteorite curation protocols, provide the most appropriate sampling procedure and stimulate and facilitate the scientific usage of the collection by the international research community. Three multidisciplinary approaches, highlighted below, are followed in the frame of the project.

The first approach investigates the best possible condition of conservation to limit the alteration process. To study the effect of the variations of temperature and humidity, we used samples of a selected H-type ordinary chondrites artificially altered in a climatic chamber. The approach selected is to experimentally reproduce in accelerate the alteration processes by taking ambient conditions (humidity and temperature) to extreme levels. Experiments were conducted over a certain amount of time to obtain significant results in terms of best temperature and humidity conditions.

The second objective is dedicated to the digitization of the most precious sample to provide on-line broaden access to rare and unique meteorite by digitizing thin sections of the most outstanding samples (achondrites and specific types of ordinary chondrites), providing directly online a navigable image obtained with the optical microscope. Such digitized thin sections will contribute to the study of RBINS meteorites, avoiding excessive handling, and will help requesters in their sample selection.

A third objective is to improve and advance the existing meteorite classification and curation at the RBINS.

Conclusions

From their recovery on the field to their storage in museum or research institute collections, meteorites are carefully maintained under controlled environments to greatly reduce the effects of terrestrial weathering. This is particularly the case for Antarctic meteorites, which are usually recovered on the field at subzero temperatures.

The present study shows how important maintaining stable environmental conditions is for the preservation of ordinary chondrites, especially the H types containing the most FeNi metal. The results show that humidity should be kept as constant as possible, and relatively low to ensure an optimal preservation of the meteorites. A humidity of 40% as this occurring in the repository of the RBINS is rather suitable. The experiments show that the temperature changes (of about 30°C) appear to be less of a problem for meteorite conservation.

Considering the limited amount of alteration material produced during the experiments, the Mössbauer spectroscopy is not the best method to investigate such processes. The XANES and the Raman spectroscopy are more efficient for this purpose.

Finally, as an outcome related to the valorisation of the RBINS collection, a new webpage showing the digitized thin sections of selected outstanding meteorites has been designed and constitutes undoubtedly a showcase helpful for international researchers interested in loans and interesting for a broader audience.

Keywords

Alteration experiments, meteorite conservation, spectroscopic study, Antarctica, meteorite thin section digitization