

**THE ROSETTA SCIENCE ARCHIVE: ENHANCING THE SCIENCE ARCHIVE CONTENT.**D. J. Heather<sup>1</sup>, M. Aberasturi<sup>1</sup>, M. Barthelemy<sup>1</sup>, D. Fraga<sup>1</sup>, L. O'Rourke<sup>1</sup>, M. Taylor<sup>2</sup><sup>1</sup>ESA/ESAC Camino Bajo del Castillo s/n, Ur. Villafranca del Castillo, 28692 Villanueva de la Canada, Madrid, Spain; <sup>2</sup>ESA/ESTEC., 2200 AG Noordwijk, Netherlands

**Introduction:** On 30 September 2016, Rosetta completed its incredible mission by landing on the surface of comet 67P/Churyumov-Gerasimenko. Although this marked an end to the spacecraft's active operations, intensive work is still ongoing, with the instrument teams updating their science data in response to recent scientific reviews and delivering them for ingestion into ESA's Planetary Science Archive (PSA) [1]. In addition to this, ESA is working with a number of instrument teams to produce new and enhanced data products and to improve documentation in an effort to provide the best long-term archive possible for the Rosetta mission.

This presentation will outline the current status of the Rosetta archive, as well as highlighting some of the 'enhanced archiving' activities that have been completed in 2017, and those that are planned / ongoing in the coming years with the various instrument teams on Rosetta.

**Status of the Rosetta data in the Planetary Science Archive:** All science data from the Rosetta mission are hosted jointly by the Planetary Science Archive (PSA) at ESA (<http://psa.esa.int>) [1], and by NASA's PDS Small Bodies Node (SBN).

The long duration of the Rosetta mission, along with its diverse suite of instrumentation and the range of targets observed throughout its lifetime combine to make this an extremely challenging mission to archive [2]. A number of independent data reviews have taken place over the course of the mission in an attempt to track the evolution of the data pipelines from each instrument and ensure that the science data are documented and formatted in the best possible way to allow end-users to exploit them. The last of these took place in October 2017, and had a focus on the science return from the comet phase of the mission. The outcome of the review was generally very positive, indicating that the data from most instrument teams are in excellent scientific shape and the Rosetta science archive is already an extremely powerful scientific resource. There were nevertheless several issues raised by the reviewers, and the instrument teams and the PSA have been working very hard to implement the fixes requested. In many cases this work is ongoing, and for all instruments, the review process has understandably resulted in a slow down of the standard delivery schedule.

Nevertheless, the majority of teams have delivered all of their data from the entire mission, and are now working on updating their comet phase data based on the outputs from the recent scientific review. The aim is to complete these updates and to work on delivering samples from the enhanced archiving activities by the end of this summer in preparation for another scientific review in autumn. This final review will assess the complete data holdings from Rosetta, and will also closely review the outputs from the enhanced archiving activities discussed in the following section. This will ensure that the archive is ready for the long-term.

It should be noted that, with the updates being made to the data pipelines as a result of the last review, teams have been asked to re-run all of their older data through the new pipelines to ensure we have consistently the best and most up to date data available in the final archive. This whole exercise is ongoing for all teams, and is expected to be completed this year.

**Rosetta Enhanced Archiving Activities:** The nominal archive deliveries from the Rosetta mission are of excellent quality, and will be of immense interest and use for many decades to come thanks to the efforts of all involved in their production, assessment, storage and dissemination. However, there is always more to do!

With the resources from the operational mission now at an end, ESA has decided to establish a number of joint activities with the Rosetta instrument teams that will allow them to continue to work on enhancing their archive content. The updates planned are focused on key aspects of an instrument's calibration or the production of higher level data / information, and are therefore very specific to each instrument's needs. Several of these activities have already been running for some or all of 2017, while others are in the process of being kicked off. They will run for various lengths depending upon the activities to be undertaken. The full 'archive enhancement' process will run until September 2019, when the post operations activities for Rosetta will come to a close.

This presentation will highlight just a few of the activities within the archive enhancement to give a flavour of the updates that have already been completed and those that are expected in the coming months.

Most instrument teams will work on providing a *Science User Guide* for their data, as well as updating calibrations for their data. Several teams will also be generating and delivering higher level processed data and derived products.

For example, the VIRTIS team are working to update both their spectral and geometrical calibrations, and will aim to deliver mapping products to the final archive in the coming year.

Similarly, the OSIRIS team will be improving their calibrations and have recently started delivering their data additionally in FITS format. They have also started to deliver quicklook (browse) versions of their products in JPG format, to allow an end-user to more easily sift through the data and select the images they may be interested in. Extended activities have now been agreed with OSIRIS, and future updates will include the delivery of straylight corrected data and three-dimensional georeferenced products.

The Rosetta Plasma Consortium (RPC) instrument suite is working on cross-calibrations that will greatly improve the final data to be delivered from each experiment, as well as a number of activities individual to each instrument (e.g. removal of spacecraft noise from the MAG instrument). An illumination map of the comet has also been produced by the RPC team to help with their cross-calibration work, and this will be prepared for delivery of the archive this year as well.

The MIDAS team is similarly be working on instrument cross-calibrations and the production of a dust particle catalog from the comet coma.

The GIADA team has started to produce higher level products in the form of dust environment maps, with products being developed in 3D plus time. Initial samples have already been delivered and are in iteration with the Rosetta archive team to prepare them for inclusion in the PSA.

The ALICE, RPC-IES and MIRO instruments on Rosetta are funded by NASA, and limited enhanced archiving activities are also being undertaken for these. The funding from NASA is more limited for Rosetta, and the resources will come to an end this year, so enhanced archiving on these instruments will wrap-up in Spring 2018, to allow the teams some funded time to respond to a review of their final submissions.

A separate activity has also been established to produce and deliver data set(s) containing supporting ground-based observations from amateur astronomers. These data were taken simultaneously with Rosetta operations and could provide some important contextual information. Initial samples of some of these products were included in the recent scientific review, and the feedback has been extremely helpful in ensuring the development is on the right track.

In addition to these activities, the Rosetta ESA archiving team will internally be producing calibrated data sets for the NAVCAM instrument, and will be working to include the latest shape models from the comet into the final Rosetta archive. The Rosetta ESA archiving team are also working on providing a centralized solution to the problem of geometry on the comet for implementation within the final Rosetta data holdings.

**Final Reviews:** The enhanced data deliveries from the 3 US funded instruments (ALICE, RPC-IES and MIRO) will be reviewed in late Spring 2018. This will be the final opportunity for these instruments to make changes to their data sets before final submission to the long-term archive.

For the remainder of instruments, a final ‘mission archive review’ will be held with independent reviewers to assess the complete Rosetta data holdings towards the end of 2018. This will also serve to assess the deliverables from the archive enhancement phase and ensure that the final Rosetta archive within the PSA is as good as it can be and will allow for scientists to fully exploit the data holdings for decades to come.

**Summary:** This presentation will outline the current status of the Rosetta science archive in ESA’s PSA and in NASA’s PDS. In addition, an overview of the activities planned and underway for enhancement of the archive content will be provided.

With the support of the instrument teams and the completion of the archive enhancement, the Rosetta archive can become an immensely valuable resource for scientists in years to come, and the full scientific potential of the mission can be realized.

**References:** [1] Besse, S. et al., (2018) Planetary and Space Science v150, 131-140; [2] Barthelemy, M. et al., (2018) Planetary and Space Science v150, 91-103.