

The First Open Competition for the MUSES-C Asteroidal Sample Preliminary Examination Team

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Preface

In the last three decades after the U.S. Apollo and the former-USSR Luna missions to the Moon, sample return programs from other celestial bodies had not been conducted. However, meteoritic scientists have collected tens of thousands of meteorites from the Antarctic and hot deserts and cosmic dust samples from the low earth orbit, stratosphere, polar ices, and deep-sea sediments. Also the advancement of analytical instruments and techniques was greatly achieved, especially in the area of micro-analysis and non-destructive analysis. As for ground observations, a number of newly discovered asteroids is exponentially increasing within the last decade, mainly due to “spaceguard” activities, which search potentially hazardous Earth-crossing asteroids down to sub-km size and determines their orbits. Statistical studies of classification of meteorite/cosmic dust as well as those of asteroids are now possible.

Then, planetary science has entered the second golden age of the minor body exploration in the new millennium, following the International Halley Watch in 1980's. A list of completed or on-going minor body missions include: NEAR-Shoemaker mission for in-orbit investigation of the asteroid Eros, STARDUST mission for sample return from Comet Wild-2, Genesis mission for sample return of solar wind implantation, CONTOUR mission for multiple fly-bys of short period comets (but failed in space), and Rosetta mission for rendezvous and landing on a comet nucleus (originally planned for Comet Wirtanen but recently postponed the launch).

The ISAS's MUSES-C mission will be a Japanese entry to this list. Although it is defined as an engineering demonstration spacecraft, its ambitious goal to collect surface materials of an asteroid is totally unprecedented and may well become a giant leap for the advancement of astromaterial research. Compared with existing meteorite and cosmic dust collections, asteroidal samples that the MUSES-C will bring back to us in the summer of 2007 are so unique and precious that they come from the definitely known parent body which will be fully investigated in-situ and they are never interacted with the terrestrial environment. Although sample return from only one type of asteroids cannot close the case, the “ground truth” to be provided by the MUSES-C sample return is surely the first step to bridge between asteroid spectral types judged by ground observation and analytical results of astromaterials in laboratories.

As this is an endeavor for all the humankind, the returned samples should be distributed to as many qualified researchers as possible all over the world for maximizing its scientific output. Yet, such detailed analysis proposals must rely on general characteristics of the samples during the initial analysis phase. The MUSES-C Asteroidal Sample Preliminary Examination Team (MASPET) will consist of ISAS scientists, NASA and Australian Co-Is, and Japanese researchers from outsourcing institutions, most of who will be selected on the basis of open competitions in respective disciplines. The MASPET is responsible for characterizing general features of the bulk and some of major samples. They also must make acquired data available to the public after the first results published; then international scientists can request samples for detailed analyses accordingly.

The first competition was conducted in 2000-2001 and the MUSES-C Sample Advisory Committee endorsed the final recommendation in May 2002. A total of eleven applications from a large variety of analytical disciplines was received and peer-reviewed. Nine of them received two sets of unknown test samples to demonstrate their self-claimed analytical performance. Multiple international referees evaluated their reports and 6 of them were recognized as qualified to join the MASPET as of 2002.

This document is a compilation of some of their analysis reports, permitted to publish by respective applicants. Therefore, each report focuses on specific suitability for general characterization of the returned samples; yet neither new discoveries nor scientific achievements of the reports are their objectives of writing. Instead, the authors demonstrate how much their technical capabilities, analytical

precision, and usefulness of the derived results for subsequent detailed analyses are worth being included in the MUSES-C initial analysis.

The competition will be repeated once more after the spacecraft launch and the final MASPET membership should be decided in the late 2005, after the spacecraft leaves the asteroid. This document may well serve the second round applicants in Japan as a reference of what levels of expertise are expected in the initial analysis phase, and any other researchers all over the world who are interested in applying for sample allocation during the detail analysis phase. This will also serve as a source book for ISAS to design an astromaterial curation and initial analysis facility.

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