2021年度 概要
OUTLINE 2021
Institute for Planetary Materials Prospectus 2021

CONTENTS

Message from the Director .......................... 2
History ................................................. 4
Organization ......................................... 4
Research Divisions .................................... 5
Joint Usage/Research Program ....................... 6
Steering Committee for the Joint Usage/Research Program ................................. 7
Facilities ............................................. 7
Graduate Education ................................... 9
Misasa International Student Intern Program ....................................................... 9
Access Guide ......................................... 10

小惑星リュウグウ
(JAXAウェブサイトより)
The asteroid Ryugu
(from JAXA website)
The Institute for Planetary Materials is located in Misasa town, Tottori Prefecture, which is a well-known hot spring resort and about 100 km away from the main campus of Okayama University (in Okayama city). The Institute has a long tradition, originating from the Institute for Thermal Spring Research (1950-1985), which was reorganized into the Institute for Study of the Earth’s Interior (ISEI) as a national collaborative research facility in 1985, and then into the current Institute for Planetary Materials in 2016.

The mission of IPM is to study the origin, evolution and dynamics of the Earth and other planets and the origin of life, and to promote collaborative research and education in Earth and planetary materials sciences by providing opportunities to access its broad spectrum of unique world-class analytical and experimental facilities to the domestic and international research community as a joint-usage/ research center (since 2010) designated by MEXT.

In the experimental field, the institute has been playing a leading role in applying high-pressure experiments, in particular using multi-anvil press to study the structure and dynamics of the Earth’s interior. In recent years, in addition to technical development in high PT generation which has pushed the record in pressure and temperature generated in a large-volume press, active research is being conducted in the study of structure and properties of deep Earth and planetary materials via high-pressure experiments, various spectroscopic and diffraction measurements (NMR, Raman, IR, X-ray diffraction, etc.) and first-principles calculations.

In the analytical field, efforts in analytical development led to the establishment of a world-class comprehensive analytical system for quantitative analyses of most elements, many isotope systems as well as dating, which has
been applied to diverse branches of materials science, such as life science and environmental science, in addition to Earth and planetary materials science. Astrobiological studies on the evolution of organic matter and origin of life are also underway.

The institute is also actively participating in international space exploration missions. Following the successful analysis of small precious samples from the sample return mission “Hayabusa”, the institute is now engaged in comprehensive analyses of samples brought back from the asteroid “Ryugu” in 2020 by the “Hayabusa 2” mission. IPM faculty is also member of the OSIRIS-Rex mission to the asteroid “Bennu”.

Graduate education is also being conducted via a doctoral program within the Graduate School of Natural Science and Technology. The annual Misasa International Student Program, which was started in 2005, has been highly successful. More than 150 students have participated in this program. Some later became graduate students at the Institute, and many are now researchers in major research institutions worldwide.

The COVID-19 pandemic has affected various activities on research, education, joint usage/ research, outreach, etc. at IPM in the last year, and we have been experimenting various strategies in order to minimize the infectious risk of COVID-19 while continuing research & educational activities. Also, this year is the final year of the 3rd mid-plan period, and we are undergoing end-of-term evaluation as a Joint Usage/Research Center and have also applied to renew the designation of the Joint Usage/Research Center by MEXT in the 4th mid-plan period in order to continue to serve the needs of the community. Your support will be highly appreciated.

Xianyu Xue
Director, Institute for Planetary Materials, Okayama University
History

1939 Misasa Hot Spring Rehabilitation Center, Okayama Medical College was established.

1943 Research Center for Radiobalneology, Okayama Medical College was established.

1949 Balneology Laboratory, Okayama University was established.

1951 Institute for Thermal Spring Research, Okayama University was established.

1985 Institute for Study of the Earth’s Interior (ISEI) was established as a national joint usage facility.

1995 ISEI was reorganized (English name unchanged).

2003 The COE-21 Program “Establishment of an International Hub in Solid Earth Science” was approved by MEXT.

2005 ISEI was reorganized (English name unchanged).

2009 The 5-year Doctoral program, Division for Earth and Planetary Materials Science, Graduate School of Natural Science and Technology was established.

2010 Designated as Joint Usage/Research Center by MEXT

2016 Institute for Planetary Materials (IPM) was established.

Organization (As of May 1, 2021)

Director
Prof. Xianyu Xue

Vice Director
Prof. Takashi Yoshino

Chair of Graduate Program
Prof. Masami Kanzaki

Director of Administration
Yasuhiko Yamashita
研究部門 Research Divisions

【惑星物質基礎科学部門】Division for Basic Planetary Materials Science
実験的及び計算的手法により、地球・惑星物質の構造と物性を明らかにし、地球・惑星の内部構造および進化過程を解明する。
To understand the internal structure and evolution of the Earth and planets via determination of the structure and physical properties of Earth and planetary materials using experimental and computational approaches.

□ 先進惑星物質解析分野
神﨑 正美 （教授）
牧嶋 昭夫 （教授）
森口 拓弥 （准教授）
山下 茂 （准教授）

Advanced Analysis of Planetary Materials
Masami Kanzaki （Professor）
Akio Makishima （Professor）
Takuya Moriguti （Associate Professor）
Shigeru Yamashita （Associate Professor）

□ 惑星深部物質分野
芳野 極 （教授）
山崎 大輔 （准教授）
辻野 典秀 （助教）

Deep Planetary Materials
Takashi Yoshino （Professor）
Daisuke Yamazaki （Associate Professor）
Noriyoshi Tsujino （Assistant Professor）

【惑星システム科学部門】Division for Planetary System
地球および地球外物質の高精度・高精度な定量分析、質量分析、分光分析等を基に、地球・惑星の起源・進化・ダイナミクスを理解する。
To understand the origin, evolution and dynamics of the Earth and planets by highly accurate/precise quantitative analysis, mass spectroscopic analysis and spectroscopic analysis of Earth and extraterrestrial materials.

□ 地球惑星年代学分野
小林 桂 （教授）
北川 宙 （助教）

Planetary Geochronology
Katsura Kobayashi （Professor）
Hiroshi Kitagawa （Assistant Professor）

□ 惑星環境進化分野
國広 卓也 （准教授）

Planetary Environmental Systems
Takuya Kunihiro （Associate Professor）

【生命・流体物質科学部門】Division for Astrobiology
実験と分析の両面から、地球惑星における鉱物-有機物-流体の相互作用を探求し、生命起源物質の進化や太陽系における原始生命に関わる痕跡を探査する。
To investigate mineral–organic–fluid interactions, origin of life, and traces of primitive life in the solar system via both experimental and analytical approaches.

□ 惑星流体物質分野
蔵 猪行 （教授）

Fluids in Planetary Systems
Xianyu Xue （Professor）

□ 生命起源物質分野
田中 亮史 （教授）
伊沢・マシュー （助教）
ボテシフル・クリスチャン （助教）

Astrobiology
Ryoji Tanaka （Professor）
Matthew Izawa （Assistant Professor）
Christian Potiszil （Assistant Professor）

□ クロスアポイントメント教授
グレイ・ビーポート
ハビエル・マーティン
マーティン・ヴァン・クラネンドンク

Cross-appointed Professors
Gray Bebout （Lehigh University, USA）
Javier Martin （University of Aberdeen, UK）
Martin Van Kranendonk （University of New South Wales, Australia）

教員

<table>
<thead>
<tr>
<th>教員</th>
<th>特別契約職員</th>
<th>事務部</th>
<th>研究スタッフ</th>
<th>大学院生</th>
<th>総計</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty</td>
<td>Tenure-track junior</td>
<td>Supervisor &amp; technicians</td>
<td>Postdoctoral Researcher</td>
<td>Cross-appointed Professors</td>
<td>Administrative staffs</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>11</td>
</tr>
</tbody>
</table>
Joint Usage/Research Program

Ever since the time of “Institute for Study of the Earth’s Interior” (1985~), The institute has been actively conducting world-class research on Earth and planetary materials science via both experimental and analytical approaches, and also promoting collaborative research with researchers both in Japan and worldwide.

Since 2010, the Institute has been designated as a Joint Usage/Research Center, “Research Center for Earth and Planetary Materials Science” supported by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan. The Institute offers joint-usage/research opportunities to both domestic and overseas researchers to access facilities and expertise for chemical analysis, dating, and structural analysis of terrestrial and extraterrestrial materials and high P-T experiments under a range of conditions.

Number of collaborative researches in the last 5 years (Blue: international; Orange: domestic
Yellow: intern program)

Duration of stay (total number of days) per year for collaborative research in the last 5 years
(Blue: international; Orange: domestic)
Steering Committee for the Joint Usage/Research Program

The Joint Usage/Research program is managed by a steering committee consisted of 5 external members and 4 IPM members.

- Prof. Takehiro Koyaguchi: Earthquake Research Institute, The University of Tokyo
- Prof. Yasuhiro Sekine: Earth-Life Science Institute, Tokyo Institute of Technology
- Prof. Hiroko Nagahara: Fellow, Tokyo Institute of Technology / Deputy Director, Research Center for Science Systems, JSPS
- Prof. Dapeng Zhao: Research Center for Prediction of Earthquakes & Volcanic Eruptions, Graduate School of Science, Tohoku University
- Prof. Hiroyuki Kagi: Geochemical Research Center, Graduate School of Science, The University of Tokyo

Director, Prof. Xianyu Xue: Institute for Planetary Materials, Okayama University

Vice Director, Prof. Takashi Yoshino: Institute for Planetary Materials, Okayama University

Facilities

- **High-pressure apparatus**
  - 6-axis high-pressure apparatus, 6UHP-70
  - KAWAI-type multi-anvil high-pressure apparatus, USSA-5000
  - DIA-type multi-anvil press UHP2000-20 (AMAGEAL)
  - Internally heated pressure vessel
  - Cold-seal hydrothermal apparatus

- **Diamond Anvil Cells (DAC)**
  - Diamond Anvil Cells (DAC)
  - Externally heated Diamond Anvil Cells
X-ray analytical equipment and Electron Microscope

- Powder X-ray diffractometer
- Micro-focused X-ray diffractometer
- X-ray fluorescence spectrometer PW2400
- Electron probe micro analyzer JXA-8800
- Field-emission Electron probe micro analyzer JXA-8530F
- Low Vacuum Field-emission SEM JSM-7001F with EDS
- SEM JSM-7001F with EDS
- Transmission Electron Microscope JEM-7001F

Mass spectrometers

- Multi-collector ICP-MS: Thermo Fisher Scientific Neptune plus
- ICP-MS: Thermo Fisher Scientific iCAP TQ
- TIMS: Thermo Fisher Scientific Triton plus
- HR-SIMS: Cameca IMS-1280HR
- Gas-MS: MAT 253 IRMS
- Gas-MS: VG 5400
- Gas-MS: Thermo Fisher Scientific Helix
- Thermo Scientific Orbitrap Fusion

Spectrometers

- NMR spectrometer Bruker Avance NEO 400MHz
- Micro-Raman spectrometer
- Terahertz micro-Raman spectrometer
- Micro-FTIR spectrometer
大学院教育 Graduate Education

平成22年より、5年間を基準修了年限とした。学部卒業後入学可能な自然科学研究科の独立専攻である一貫制博士課程「地球惑星物質科学専攻」を創設した。この課程は、「分析地球惑星化学講座」と「実験地球惑星物理学講座」の二つの講座からなり、国際的な環境下での授業・研究指導及び海外教授を加えた学位審査体制を特徴とする。研究所独自の奨学金やリサーチアシスタントとしての雇用により、授業料および生活費に関わる補助（最長5年間）を申請することが可能である。また、惑星物質研究所は、学生的学会発表奨励するため、学会発表補助プログラムを実施している。

Since 2009, the Institute adopted a doctoral program as an independent Division for Earth and Planetary Materials Science within the Graduate School of Natural Science and Technology. It consists of two departments: Department of Analytical Planetary Chemistry and Department of Experimental Planetary Physics. The program has a standard period of five years after enrollment, and no prior Master degree is required. Qualified students may apply financial support, in the form of fellowship and research assistantship, for a maximum of five years to cover their tuition fees and living expenses. For international students, lectures and guidance in research in English are provided as needed. The Institute also provides a student conference travel grant program in order to encourage student conference presentation.

三朝国際学生インターンプログラム Misasa International Student Intern Program

平成17年度より、毎年、世界各国から、学部3・4年生ならびに修士課程学生（国籍は問わない）10名程度を対象に「三朝国際学生インターンプログラム」を约6週間にわたって実施している。このプログラムでは、当機頂の職員の研究プロジェクトに基づき、教員・研究グループの指導のもと、学生が主体的に実施するものであり、最終的に国際誌に論文として公表される場合も多い先進的な研究を経験できることが最大の特色である。インターン生には高度な実験・分析技術の実体験に留まらず、研究者としての思考プロセス習得やプレゼンテーション能力の向上、研究への情熱の涵養が期待される。プログラム実施から15年以上が経過し、150人を超える修了者を輩出した。その一部はその後当研究所の博士課程に入学し、多くは現在各国の主要研究機関で研究者として活躍している。令和2年度～令和3年度は、新型コロナウイルス感染拡大の影響で、実施は中止しているが、今後状況が許されるようになったら、再開したい。

Since 2005, the Institute has been holding an annual Misasa International Student Intern Program for advanced undergraduate and Master students each year for about 6 weeks in order to promote international collaborative research and education. During the intern program, each student works on an active IPM research project under the supervision of IPM faculty members and their research groups. The program has been well received internationally, attracting a large number of applicants from worldwide each year. More than 150 students have participated in the program. Some of them later became graduate student at the Institute, many are now researchers in major research institutions worldwide. The program could not be carried out in FY 2020-2021 due to the COVID-19 pandemic, but we hope it will be resumed in the future.

Numbers of applicants (Blue) and participants (Orange) for the Misasa International Student Intern Program from 2016 (H28) to 2020 (R2).