

## Report of the International Workshop on Renaissance Drilling on the Northwestern Pacific, 18–19 March 2023, Niigata, Japan

Atsushi MATSUOKA\*, Erika TANAKA\*\*, Kazutaka YASUKAWA\*\*\* and  
Junichiro KURODA\*\*\*\*

### Abstract

The International Workshop on Renaissance Drilling on the Northwestern Pacific was organized in Niigata during 18–19 March 2023, hosted by Niigata University and co-sponsored by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC). A total of 30 participants from 4 countries attended the workshop. The scientific sessions were held on 18 March, followed by a discussion meeting on 19 March in the “Eki-nan” Campus TOKIMATE of Niigata University. This report summarizes the international workshop including the contents of scientific sessions in Niigata and post-meeting field activities during 20–22 March in Kochi.

*Key words:* International workshop, deep-sea drilling, pelagic clay, chert, radiolaria, fish debris, Jurassic–Cretaceous boundary.

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\* Department of Geology, Faculty of Science, Niigata University, Niigata 950–2181, Japan

\*\* Marine Core Research Institute, Kochi University, Nankoku 783–8502, Japan

\*\*\* Frontier Research Center for Energy and Resources (FR CER), School of Engineering, The University of Tokyo, Tokyo, 113–8656, Japan

\*\*\*\* Atmosphere & Ocean Research Institute (AORI), The University of Tokyo, Kashiwa 277–8563, Japan

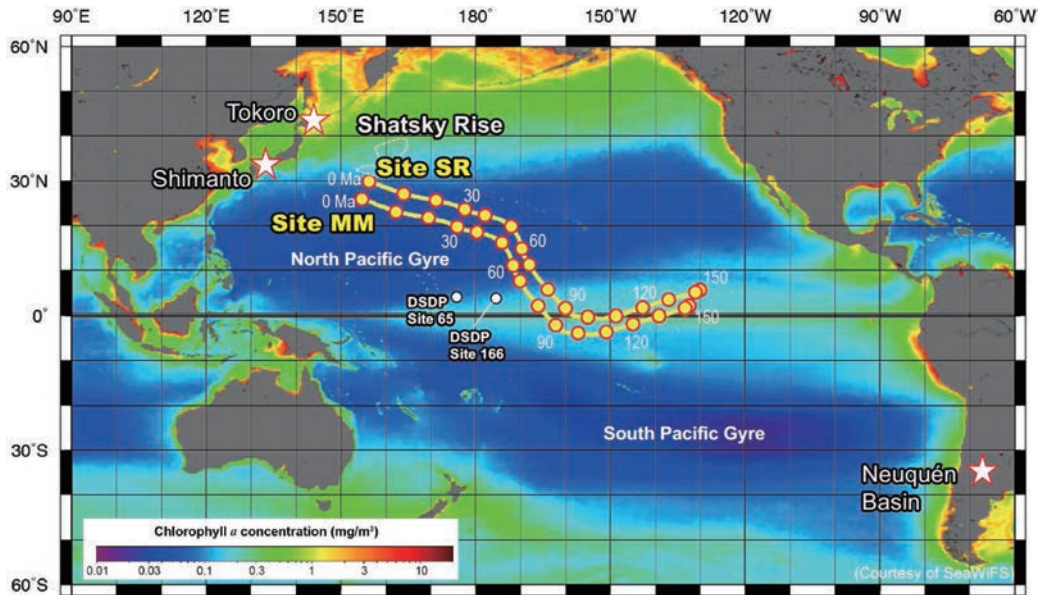
Corresponding author: A. Matsuoka,  
amatsuoka@geo.sc.niigata-u.ac.jp

## Introduction

The Pacific Ocean has been the largest ocean during the Mesozoic and Cenozoic and contains various types of sediments on the seafloor. Previous studies focused mainly on carbonate-bearing sediments to discuss the oceanic, biological, and geochemical evolution. However, chert and pelagic clay also have comparable, or complementary, information to that of carbonate. Radiolarians in chert were the main component of the pelagic siliceous sediments during the Mesozoic, and their diversity should have reflected local to global environmental changes. Recent studies on pelagic clay discovered that transient increase of the fish debris (teeth/bones) accumulation occurred repeatedly in the Pacific Ocean. For the complete understanding of the oceanic and biological evolution since the Mesozoic, it is essential to utilize the chert and pelagic clay as well as carbonate.

We submitted a drilling proposal for the International Ocean Discovery Program (IODP) in April, 2021 under the title of “The Renaissance of the oldest Pacific sediments: Trans-Pacific records of co-evolution of geochemistry, marine ecosystem, and sediment lithology in the pelagic realm.” The proposal aims to recover the latest Jurassic to Cenozoic sediments on the Pacific abyssal plain (Site MM) and around Shatsky Rise (Site SR) (Fig. 1). Our primary objectives are (1) to elucidate the changes in marine biota across the Jurassic–Cretaceous boundary (JKB), (2) to understand the long-term transition from a Mesozoic chert-rich ocean to a Cenozoic chert-poor ocean including a change in diversity of radiolarians, and (3) to decipher the environmental change recorded as an enrichment of fish-remains, and rare-earth elements and yttrium (REY), in the pelagic clay during the Late Cretaceous and Cenozoic. The content of the proposal was presented at the 2021 annual meeting of the Geological Society of Japan (Matsuoka et al., 2021a) and at the Second International Symposium of the International Geoscience Programme Project 679 in Qingdao, China (Matsuoka et al., 2021b).

After receiving comments by the Scientific Evaluation Panel of the IODP in September, 2021, we realized the necessity of having an opportunity to discuss on deep sea drilling in the northwest Pacific to polish our scientific goals. We planned to organize an international workshop in the 2021 fiscal year but it had to be postponed due to the Covid-19 pandemic. The International Workshop entitled “Renaissance Drilling on the Northwestern Pacific” was performed in March 2023, having a chance to exchange ideas among a wide variety of scientists including stratigrapher, paleontologists, geochemists, paleomagnetic specialists and so on. This report summarizes the workshop including the contents of scientific sessions in Niigata and post-meeting field activities in Kochi.



**Fig. 1.** Reconstructed track of the proposed sites. Yellow circles indicate paleopositions of the proposed sites in 10-million-year steps, with numbers showing the age in million years ago. The reconstruction was created by using GPlates software (<http://www.gplates.org>) based on the plate polygon and rotation data by Matthews et al. (2016). Background is modern global sea-surface chlorophyll *a* concentration (courtesy of SeaWiFS Project, NASA). White stars indicate terrestrial sections, Tokoro and Shimanto belts in Japan and Neuquén Basin in Argentina, that relate to the trans-Pacific records which this proposal targets.

### Outline of the International Workshop

The scientific sessions of the workshop were held on 18 March at the “Eki-nan” Campus TOKIMATE of Niigata University. A total of 30 participants attended the meeting from 4 countries; China, Italy, Japan, and the United States of America. The program of the scientific sessions is shown in Fig. 2. They were composed of 16 oral presentations in three topics, namely Frontier Research on Pelagic Clay (Chairs: YASUKAWA, K. and TANAKA, E.), Co-evolution of Pelagic Life and Lithology (Chairs: KURODA, J. and MATSUOKA, A.), and Jurassic/Cretaceous Boundary (Chairs: MATSUOKA, A. and KURODA, J.). Two presentations in the Frontier Research on Pelagic Clay session were given on line by scientists in the U.S.A.

The workshop started with a welcome address and general introduction which included the following explanation and proposal of drilling sites (Fig. 3A). To study the turnovers of marine biota at pelagic sites in the Pacific Ocean across the JKB, both siliceous and calcareous fossils are required to be preserved. A promising sediment succession across the JKB could exist underneath the seafloor at the middle flank of Shatsky Rise. To investigate the transition from a Mesozoic chert-rich ocean to a Cenozoic chert-poor ocean, it is critical

Workshop Program on Saturday, 18th March	
08:30-08:50	WELCOME & INTRODUCTION
<b>Session 1. Frontier Research on Pelagic Clay</b> Chairs: K. YASUKAWA & E. TANAKA	
08:50-09:15	<b>YASUKAWA, Kazutaka</b> University of Tokyo Pelagic clay revisited: Perspectives from a potential mineral resource and paleoceanographic archive
09:15-09:40	<b>DUNLEA, Ann</b> Woods Hole Oceanographic Institution (WHOI) Distinguishing the contributions of dust and volcanic ash to pelagic clay
09:40-10:05	<b>SIBERT, Elizabeth</b> Yale University Microfossils in Pelagic Clays: an overlooked but valuable tool for studying ecological response to global change
10:05-10:15	BREAK
10:15-10:40	<b>TANAKA, Erika</b> Kochi University Reconstruction of long-term depositional environmental changes using pelagic clay in the area around Minamitorishima (Marcus) Island
10:40-11:05	<b>USUI, Yoichi</b> Kanazawa University Proposed Chikyu Shallow Core Program (SCORE) around Minamitorishima Island within the framework Cenozoic paleoceanography of North Pacific
11:05-11:30	<b>IJIMA, Koichi</b> Japan Agency for Marine-Earth Science and Technology (JAMSTEC) Lithology and physical properties of pelagic sediment cores around Minamitorishima (Marcus) island
<b>Session 2. Co-evolution of Pelagic Life and Lithology</b> Chairs: J. KURODA & A. MATSUOKA	
11:30-11:55	<b>KURODA, Junichiro</b> University of Tokyo An overview of the sediments on the Shatsky Rise and its potential as a paleoenvironmental archive
11:55-13:30	LUNCH BREAK
13:30-13:55	<b>MATSUOKA, Atsushi</b> Niigata University Radiolarian evolution and lithological transition from chert to pelagic clay in the Pacific
13:55-14:20	<b>KIMOTO, Katsunori</b> JAMSTEC Detection of density differences in radiolarian skeletons by micro-CT measurement
14:20-14:45	<b>YOSHINO, Takashi</b> Toyo University Micro-CT technology and morphological analysis of radiolarian skeletons
<b>Session 3. Jurassic/Cretaceous Boundary</b> Chairs: A. MATSUOKA & J. KURODA	
14:45-15:10	<b>LI, Xin</b> Nanjing Institute of Geology and Palaeontology The Jurassic/Cretaceous boundary in China
15:10-15:30	BREAK
15:30-15:55	<b>ERBA, Elisabetta</b> University of Milan (UNIMI) Calcareous nannofossil characterisation of the Jurassic-Cretaceous transition: western Pacific and global data
15:55-16:20	<b>ITO, Tsuyoshi</b> Geological Survey of Japan, AIST Radiolarian-bearing clasts within the Jurassic-Cretaceous neritic-terrestrial strata in East Asia
16:20-16:45	<b>TAKETANI, Yojiro</b> Fukushima Museum The Jurassic/Cretaceous boundary in the South Kitakami Terrane, northeast Japan
16:45-17:10	<b>NAKADA, Kentaro</b> Fukui Prefectural Dinosaur Museum The ammonite biostratigraphy around the Jurassic/Cretaceous boundary in Japan
17:10-17:35	<b>SANO, Shinichi</b> University of Toyama Searching for a Jurassic/Cretaceous boundary in northern Central Japan
17:35-17:50	BREAK
17:50-18:30	JOINT DISCUSSIONS

Fig. 2. Program of the International Workshop on Renaissance Drilling on the Northwestern Pacific on 18 March in 2023 at the “Eki-nan” Campus TOKIMATE of Niigata University.





**Fig. 3.** Photographs of the workshop. **A.** The workshop was held in Lecture Room in the TOKIMATE on 18 March, **B.** Group photograph of the participants of the workshop, **C.** Separate meeting (Mesozoic chert session) on 19 March in Meeting Room A in the TOKIMATE.

to confirm the boundary layer from the chert/silica-rich sediments to the clayey/silica-poor sediments and to elucidate factors (e.g., environmental changes and/or physicochemical processes during early diagenesis) that caused the lithological transition. To verify the relationship among the enrichment of fish remains (and REY), paleoceanographic conditions, and geochemical cycles, a complete set of pelagic clay of the Cretaceous to Paleogene is required. For these purposes, we proposed drilling the southern foot of Shatsky Rise and north of Minamitorishima (Site SR and Site MM in Fig. 1, respectively).

At the end of the workshop on the first day, a group photograph was taken at Lecture Room (Fig. 3B). The welcome party was held in the evening of 18 March at Art Hotel Niigata Station located in the same building as the TOKIMATE.

In the morning session of 19 March, the participants were divided into two groups: Cenozoic pelagic clay session and Mesozoic chert session (including the JKB and chert-clay transition). In the pelagic clay session, scientific objectives were confirmed as reconstructing (1) long-term ecological record in pelagic clay, (2) plate tectonics and atmospheric circulations related to circum-Pacific, and (3) seafloor environmental changes through the Cenozoic. The participants agreed with the need for drilling of new reference sites in the western North Pacific which can be compared with other sites/areas (e.g., eastern North Pacific and South Pacific Gyre). In the chert session (Fig. 3C), one of the major discussion topics was stratigraphic correlations among deep-sea, neritic and terrestrial sequences around the JKB, which is essential for establishing a world-wide standard. It was pointed out that less altered deep-sea cores are advantageous not only biostratigraphy but also chemostratigraphy. The importance of micro-CT analysis for radiolarian skeletons was realized as a new method for evaluating physical property.

In the afternoon of 19 March, a special lecture on seismic survey for a successful drilling proposal was provided by PARK J. (Univ. Tokyo). The title was "Spatiotemporal scale of large-scale hydrothermal circulation system connecting ocean and mantle at the outer rise." The lecture included technical issues on the shipboard seismic survey and introduced a research topic on the sub-bottom reflection data from the outer rise along the Japan Trench, western North Pacific. After the special lecture, a joint discussion by all participants was performed and the results of each group were summed up.

### **Post-meeting activities**

Post-meeting activities in Kochi Prefecture included a visit to the Kochi Core Center in Nankoku City on 20 March, rock sampling in the Birafu section in Kami City on 21 and 22 March and an excursion of the Yokonami mélange in Susaki City on 23 March (Fig. 4).





**Fig. 4.** Post-workshop activities in Kochi. **A.** Visit to the Kochi Core Center in Nankoku City on 20 March, **B.** Sampling in the Birafu section in Kami City on 21 and 22 March, **C.** Group photograph on the lower Cretaceous Yokonami chert in Susaki City on 23 March.

### 1. Visit to the Kochi Core Center

In the afternoon of 20 March, MATSUOKA, A. and ERBA, E. visited the center and had a look at the facilities including the core repository and several laboratories (Fig. 4A).

### 2. Rock sampling in the Birafu section

The upper Jurassic–lower Cretaceous Birafu Formation, one of equivalents of the Torinosu Group in the Chichibu belt is well exposed along the Nishinokawa River in the Birafu area, Kami City. Limestone and mudstone samples of the Birafu Formation were collected for radiolarian-calcareous nannofossil biostratigraphy and osmium isotope analysis along the river on 21 and 22 March (Fig. 4B).

### 3. Excursion of the Yokonami mélange

The Yokoyami mélange is well exposed in the east coast of the Yokonami Peninsula, Susaki City on 23 March. The mélange includes various rock types of ocean plate stratigraphy. An excursion was organized to observe the lower Cretaceous chert and upper Cretaceous hemipelagic–terrigenous sequences in the mélange (Fig. 4C).

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