Strasser, M., Dugan, B., Kanagawa, K., Moore, G.F., Toczko, S., Maeda, L., and the Expedition 338 Scientists
Proceedings of the Integrated Ocean Drilling Program Volume 338
publications.iodp.org

Data report: major and trace element geochemistry of Shikoku Basin sediments from IODP Expedition 322 Sites C0011 and C0012 and Expedition 338 Site C0022[1]

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[1] Sawada, Y., and Hayashi, H., 2025. Data report: major and trace element geochemistry of Shikoku Basin sediments from IODP Expedition 322 Sites C0011 and C0012 and Expedition 338 Site C0022. In Strasser, M., Dugan, B., Kanagawa, K., Moore, G.F., Toczko, S., Maeda, L., and the Expedition 338 Scientists, Proceedings of the Integrated Ocean Drilling Program, 338: Yokohama (Integrated Ocean Drilling Program). https://doi.org/10.2204/iodp.proc.338.209.2025
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Keywords
Integrated Ocean Drilling Program, *Chikyu*, Expedition 322, Expedition 338, Nankai Trough Seismogenic Zone Experiment, NanTroSEIZE, Site C0011, Site C0012, Site C0022, major and trace element, Shikoku Basin

References (RIS)

MS 338-209
Received 4 September 2024
Accepted 10 November 2024
Published 7 February 2025

Abstract

Sediment core samples from Integrated Ocean Drilling Program Expedition 322 Sites C0011 and C0012 in the Shikoku Basin and Expedition 338 Site C0022 on the slope basin southeast of Kii Peninsula were analyzed for major and trace elements using X-ray fluorescence spectrometry. At Site C0011, 26 samples were taken from the stratigraphic interval between 350 and 764 m core depth below seafloor, Method A (CSF-A). At Site C0012, 23 samples were taken between 70 and 476 m CSF-A. At Site C0022, six samples were taken between 157 and 416 m CSF-A. Analytical results are discussed in this data report.

1. Introduction

Surface sediments in the Shikoku Basin form part of the Philippine Sea plate, which is subducted beneath the Southwest Japan Arc. These sediments therefore potentially influence material circulation in the wedge mantle and crust, as well as magma generation. The chemical compositions of sediments are basic but important data. Although there are some reports of major element compositions of the sediments in this area and also of major and trace element concentrations in pore waters (Expedition 322 Scientists, 2010a, 2010b), trace element data for the sediments themselves are largely lacking. In this study, sediment core samples from Integrated Ocean Drilling Program Expedition 322 Sites C0011 and C0012 in the Shikoku Basin and Expedition 338 Site C0022 on the slope basin southeast of Kii Peninsula (Figure **F1**) were analyzed for their major and trace element compositions using X-ray fluorescence (XRF) spectrometry.

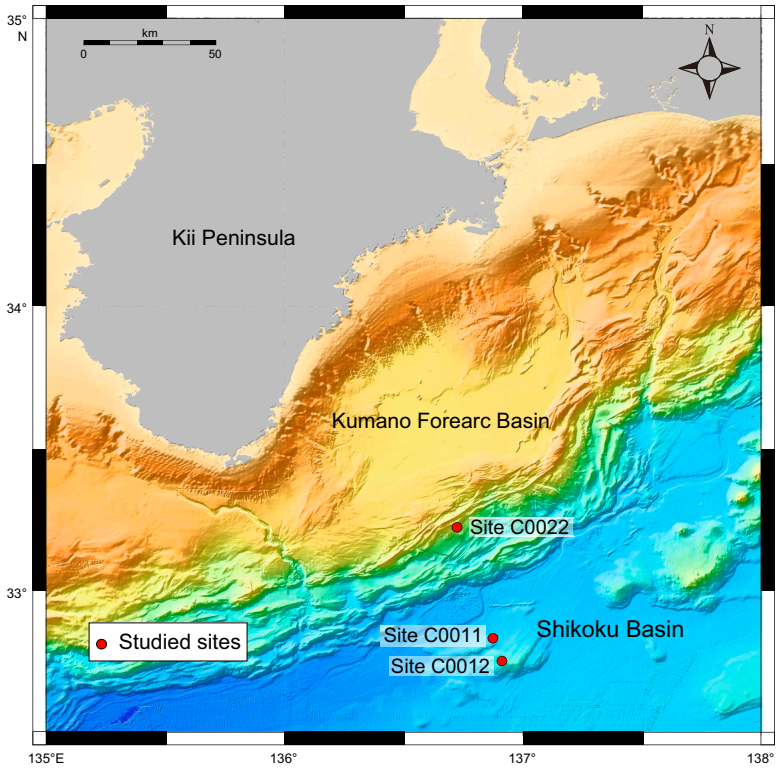

Figure F1. Location of Sites C0011, C0012, and C0022 (modified after Figure F1 of Strasser et al., 2014a).

2. Samples

In all, 55 samples, each about 15 g, were taken from the cores listed above. A total of 26 samples were taken from the stratigraphic interval between 350 and 764 m core depth below seafloor, Method A (CSF-A) in Hole C0011B. These samples are composed of hemipelagic mudstone with a stratigraphic interval between the Middle and Late Miocene (Expedition 322 Scientists, 2010a). Another 23 samples were taken between 70 and 476 m CSF-A in Hole C0012A, and these also consisted of hemipelagic mudstone. The stratigraphic interval of these samples ranges from Middle Miocene to Pliocene (Expedition 322 Scientists, 2010b). Six samples were also taken between 157 and 416 m CSF-A in Hole C0022B in the Pleistocene slope sediments interval (**Strasser et al.**, 2014b). These samples are hemipelagic silty clays.

3. Sample preparation and analytical methods

Powder samples for XRF analysis were prepared by grinding in an automatic agate mortar. The powdered samples were heated in a furnace at 800°C for 8 h, and loss on ignition (LOI) was then determined from the total weight loss of each sample after heating.

Major and trace element abundances in the samples were determined using XRF. Abundances of the 10 major oxides (Si, Ti, Al, Fe, Mn, Mg, Ca, Na, K, and P) and 13 trace elements (Ba, Ce, Cr, Ga, Nb, Ni, Pb, Rb, Sr, Th, V, Y, and Zr) were determined by a well-established glass bead method using a Rigaku PRIMUS-II XRF at Okayama University. The glass beads were prepared using an NT-2000 automatic bead sampler, which fused samples mixed with a flux consisting of a 4:1 mixture of $Li_2B_4O_7$:$LiBO_2$ using a sample to flux ratio of 1:2 following the method of Sawada et al. (2018).

4. Analytical results

LOI values range 8.63–17.96 wt% for samples from Hole C0011B, 10.51–18.46 wt% for samples from Hole C0012A, and 6.12–12.52 wt% for samples from Hole C0022B.

Major and trace element compositions of the sediment samples are listed in Tables **T1**, **T2**, and **T3**, and Figures **F2**, **F3**, **F4**, **F5**, and **F6** show the elemental variations with depth in the drill cores. Noteworthy features of the major and trace element compositions are listed below.

Table T1. Concentrations of major and trace elements of bulk sediment samples, Hole C0011B. **Download table in CSV format.**

Table T2. Concentrations of major and trace elements of bulk sediment samples, Hole C0012A. **Download table in CSV format.**

Table T3. Concentrations of major and trace elements of bulk sediment samples, Hole C0022B. **Download table in CSV format.**

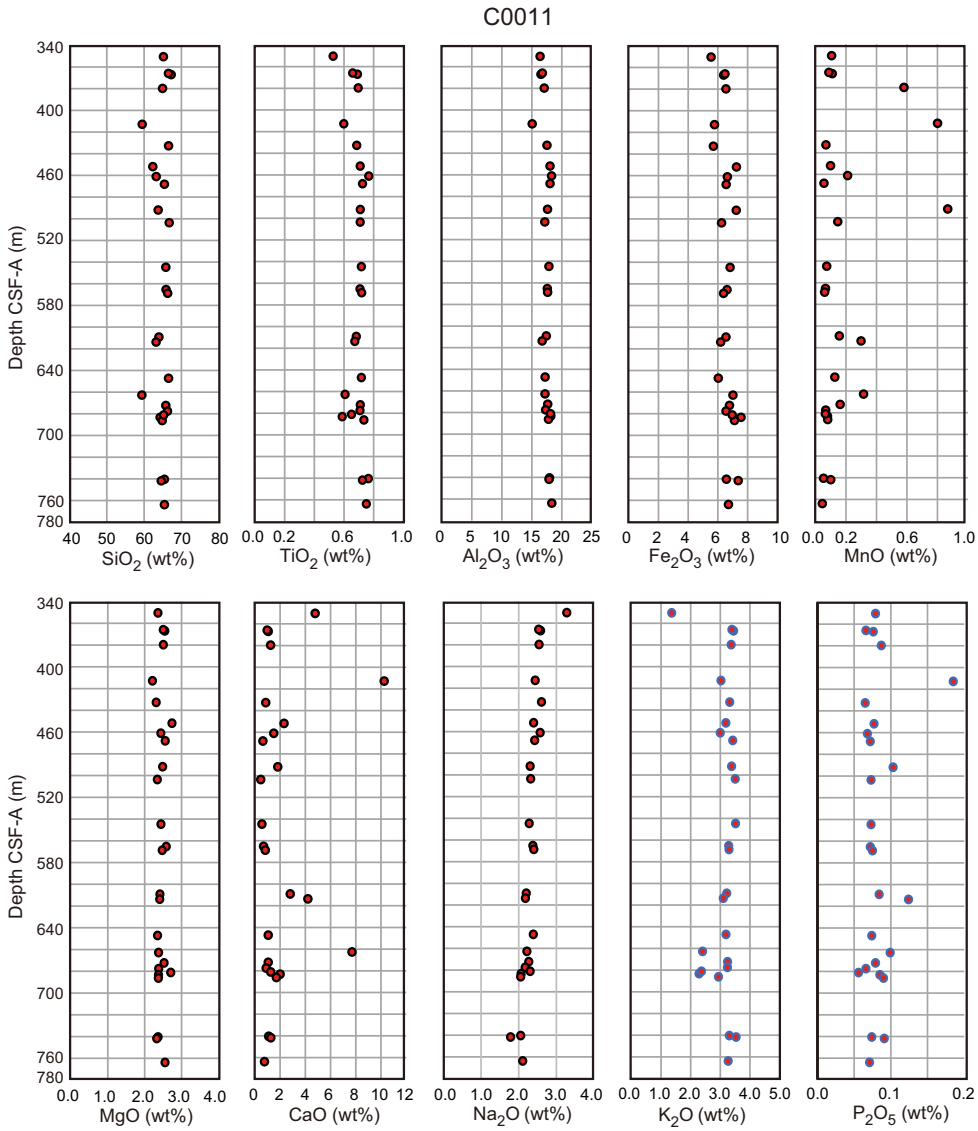

Figure F2. Variations of major elements, Site C0011.

4.1. Hole C0011B

SiO_2 contents range 59.37–67.23 wt%. Two samples with the lowest SiO_2 contents (322-C0011B-38R-07: SiO_2 = 59.47 wt%; 36R-07: SiO_2 = 59.37 wt%) are distinguished by high CaO contents (10.24 and 7.70 wt%, respectively). In all other samples in this core, CaO values are less than 4.78

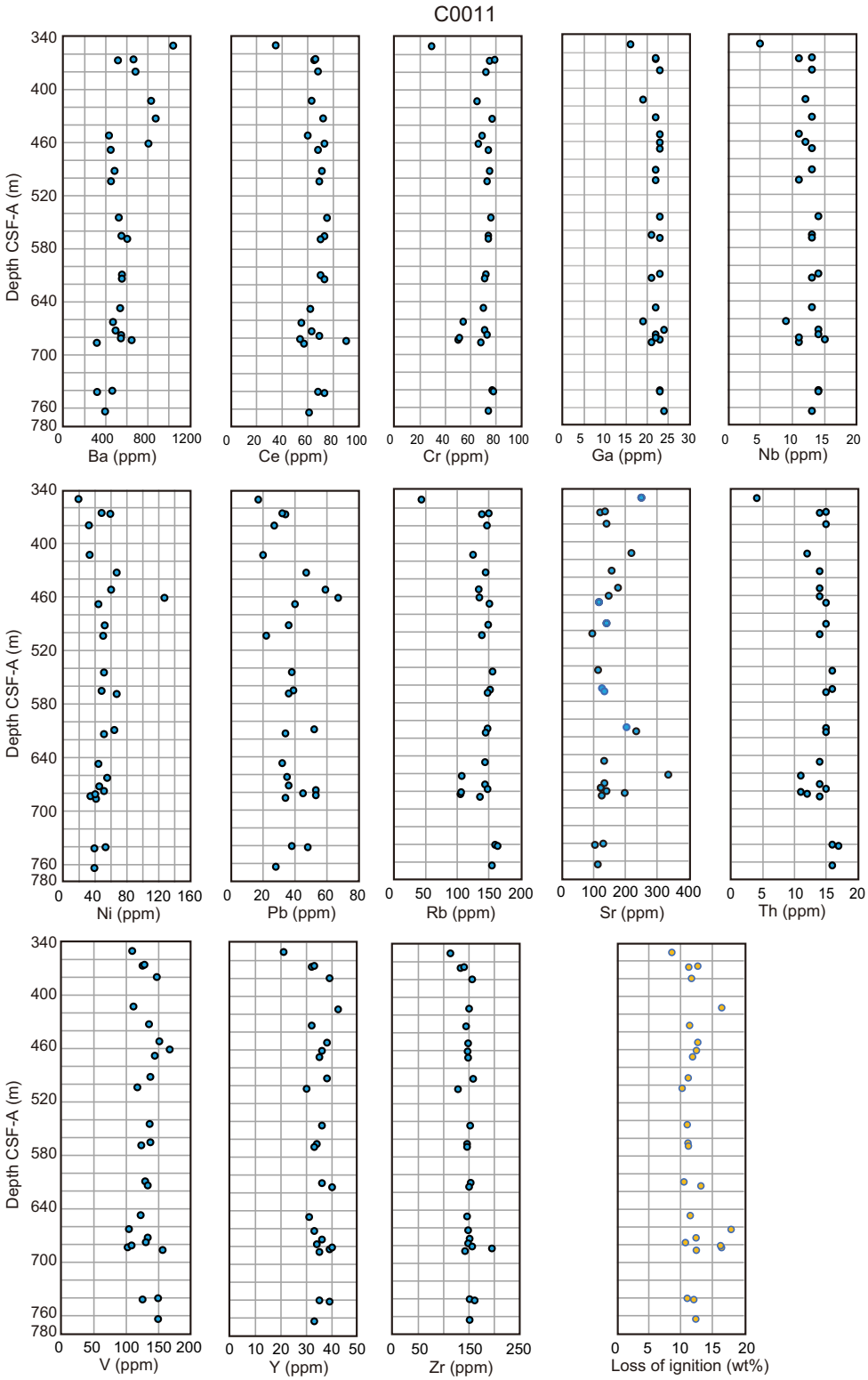

Figure F3. Variations of trace elements, Hole C0011B.

wt%. Sample 2R-01 shows some contrasts with the other samples with relative enrichment in SiO_2 (65.15 wt%), CaO (4.78 wt%), Na_2O (3.27 wt%), Ba (1041 ppm), and Sr (251 ppm). Concentrations of the other trace elements are lower than those in the other samples. Sample 14R-01 is relatively enriched in Ni (127 ppm) and Pb (67 ppm), whereas Sample 38R-07 has the highest Sr content (336 ppm).

4.2. Hole C0012A

SiO_2 contents lie in the range of 58.33–68.29 wt%, except for Sample 322-C0012A-29R-01, which has a lower SiO_2 content of 52.01 wt%. Sample 29R-01 is highly enriched in MnO (2.37 wt%) and CaO (18.58 wt%), slightly enriched in P_2O_5 (0.20 wt%), and mildly depleted in Al_2O_3 (14.05 wt%). Sample 46R-04 is enriched in CaO (10.95 wt%), Ba (1057 ppm), and Sr (395 ppm).

4.3. Hole C0022B

LOI and CaO contents of Sample 338-C0022B-19X-CC (the uppermost sample analyzed from this site) are 12.52 and 6.16 wt%, respectively. Otherwise, there are no great differences in the concentrations of any element in the samples at this site.

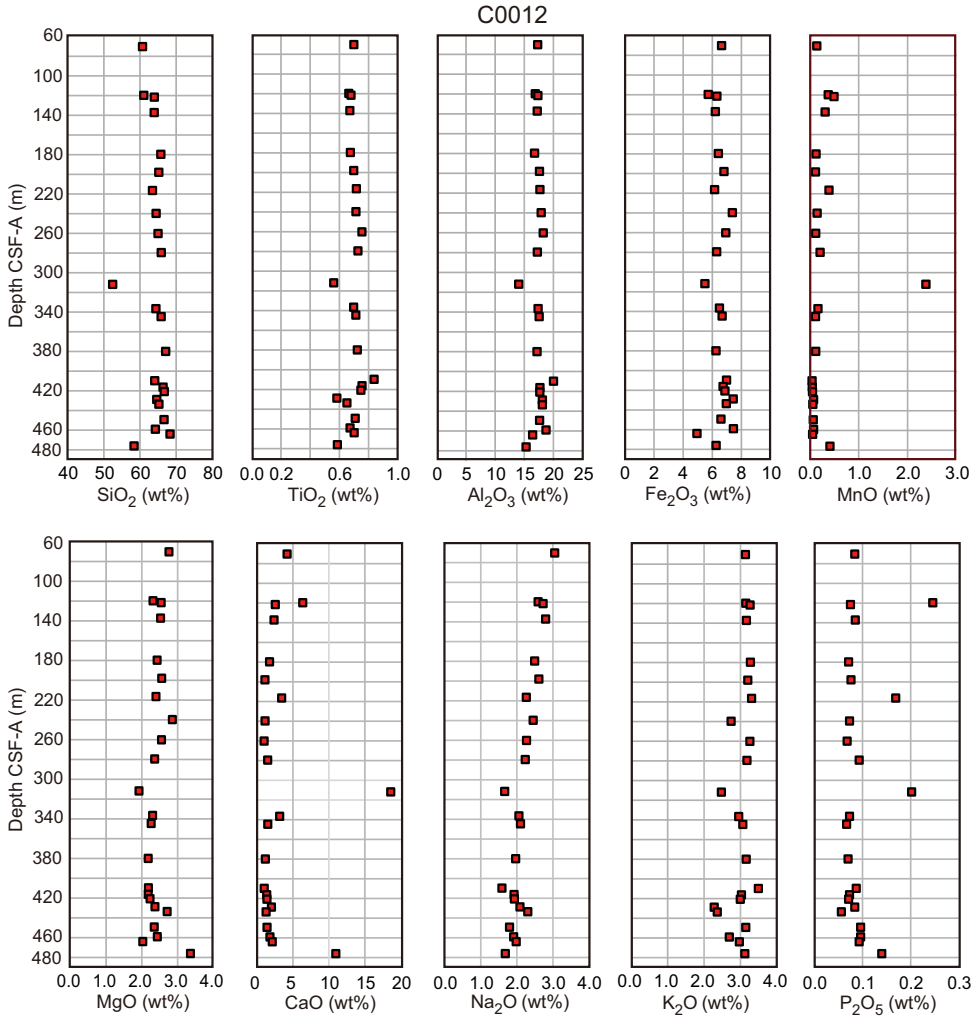

Figure F4. Variations of major elements, Hole C0012A.

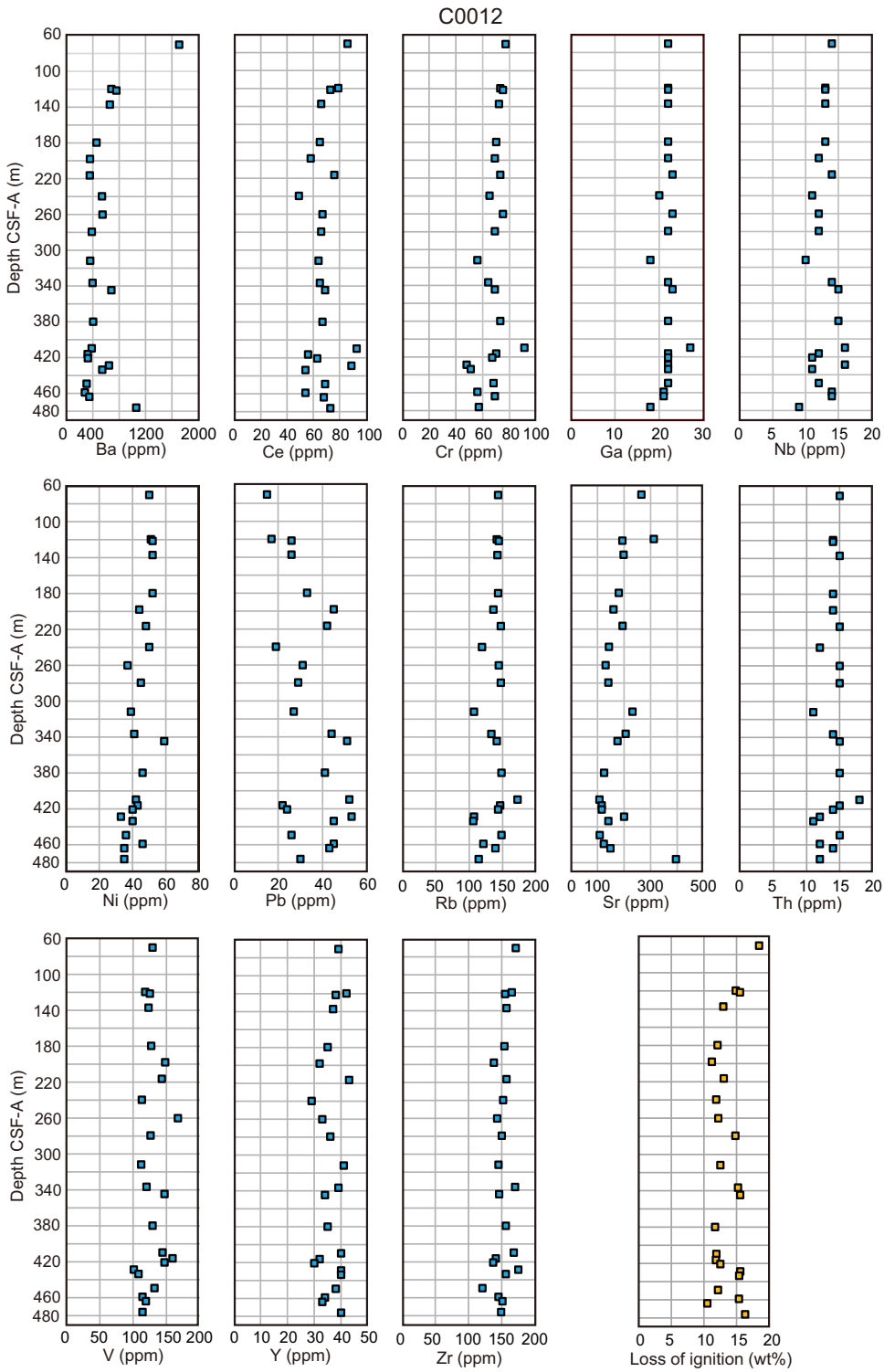

Figure F5. Variations of trace elements, Hole C0012A.

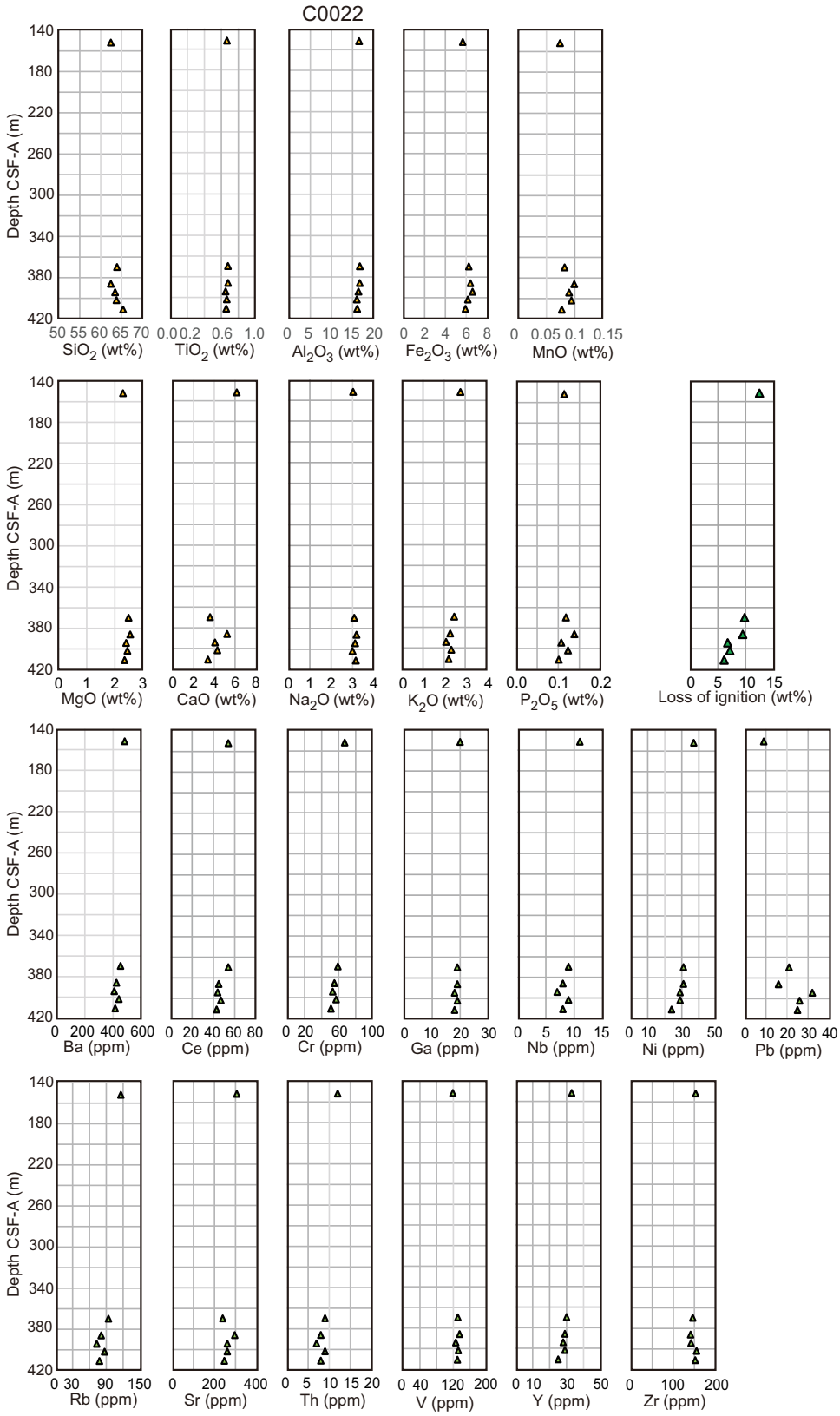

Figure F6. Variations of major and trace elements, Hole C0022B.

5. Acknowledgments

For this work, we used an automatic agate mortar to prepare powder samples and an electric furnace for LOI at Shimane University, a bead sampler to produce glass beads at Okayama University of Science, and XRF facilities at Okayama University to generate the compositional data. We thank these universities for access to their equipment. We also thank Dr. Barry Roser for helpful suggestions on this report. The manuscript has been improved by a constructive reviewer. This research used samples (request ID: 105959IODP) provided by the International Ocean Discovery Program.

References

Expedition 322 Scientists, 2010a. Site C0011. In Saito, S., Underwood, M.B., Kubo, Y., and the Expedition 322 Scientists, Proceedings of the Integrated Ocean Drilling Program, 322: Tokyo (Integrated Ocean Drilling Program Management International, Inc.). **https://doi.org/10.2204/iodp.proc.322.103.2010**

Expedition 322 Scientists, 2010b. Site C0012. In Saito, S., Underwood, M.B., Kubo, Y., and the Expedition 322 Scientists, Proceedings of the Integrated Ocean Drilling Program, 322: Tokyo (Integrated Ocean Drilling Program Management International, Inc.). **https://doi.org/10.2204/iodp.proc.322.104.2010**

Sawada, Y., Nakao, F., Imayama, T., and Benino, Y., 2018. Analytical method and accuracy of X-ray fluorescence analysis at Okayama University. The Bulletin of Research Institute of Natural Sciences, Okayama University of Science, (44):51-53.

Strasser, M., Dugan, B., Kanagawa, K., Moore, G.F., Toczko, S., Maeda, L., Kido, Y., Moe, K.T., Sanada, Y., Esteban, L., Fabbri, O., Geersen, J., Hammerschmidt, S., Hayashi, H., Heirman, K., Hüpers, A., Jurado Rodriguez, M.J., Kameo, K., Kanamatsu, T., Kitajima, H., Masuda, H., Milliken, K., Mishra, R., Motoyama, I., Olcott, K., Oohashi, K., Pickering, K.T., Ramirez, S.G., Rashid, H., Sawyer, D., Schleicher, A., Shan, Y., Skarbek, R., Song, I., Takeshita, T., Toki, T., Tudge, J., Webb, S., Wilson, D.J., Wu, H.-Y., and Yamaguchi, A., 2014a. Expedition 338 summary. In Strasser, M., Dugan, B., Kanagawa, K., Moore, G.F., Toczko, S., Maeda, L., and the Expedition 338 Scientists, Proceedings of the Integrated Ocean Drilling Program, 338: Yokohama (Integrated Ocean Drilling Program). **https://doi.org/10.2204/iodp.proc.338.101.2014**

Strasser, M., Dugan, B., Kanagawa, K., Moore, G.F., Toczko, S., Maeda, L., Kido, Y., Moe, K.T., Sanada, Y., Esteban, L., Fabbri, O., Geersen, J., Hammerschmidt, S., Hayashi, H., Heirman, K., Hüpers, A., Jurado Rodriguez, M.J., Kameo, K., Kanamatsu, T., Kitajima, H., Masuda, H., Milliken, K., Mishra, R., Motoyama, I., Olcott, K., Oohashi, K., Pickering, K.T., Ramirez, S.G., Rashid, H., Sawyer, D., Schleicher, A., Shan, Y., Skarbek, R., Song, I., Takeshita, T., Toki, T., Tudge, J., Webb, S., Wilson, D.J., Wu, H.-Y., and Yamaguchi, A., 2014b. Site C0022. In Strasser, M., Dugan, B., Kanagawa, K., Moore, G.F., Toczko, S., Maeda, L., and the Expedition 338 Scientists, Proceedings of the Integrated Ocean Drilling Program, 338: Yokohama (Integrated Ocean Drilling Program). **https://doi.org/10.2204/iodp.proc.338.107.2014**