

Proceedings of the International Ocean Discovery Program

Volume 383

Dynamics of the Pacific Antarctic Circumpolar Current

Expedition 383 of the R/V *JOIDES Resolution*

from and to Punta Arenas, Chile

Sites U1539–U1544

20 May–20 July 2019

Volume authorship

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Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the participating agencies, TAMU, or Texas A&M Research Foundation.

The bulk of the shipboard-collected core data from this expedition is accessible at <http://iodp.tamu.edu/database/index.html>. If you cannot access this site or need additional data, please contact Data Librarian, International Ocean Discovery Program *JOIDES Resolution* Science Operator, Texas A&M University, 1000 Discovery Drive, College Station TX 77845-9547, USA. Tel: (979) 845-8495; Fax: (979) 458-1617; Email: database@iodp.tamu.edu.

A complete set of the logging data collected during the expedition is available at http://mlp.ldeo.columbia.edu/logdb/scientific_ocean_drilling. If you have problems downloading the data, wish to receive additional logging data, or have questions regarding the data, please contact Database Administrator, Borehole Research Group, Lamont-Doherty Earth Observatory of Columbia University, PO Box 1000, 61 Route 9W, Palisades NY 10964, USA. Tel: (845) 365-8343; Fax: (845) 365-3182; Email: logdb@ldeo.columbia.edu.

Supplemental data were provided by the authors and may not conform to IODP publication formats.

JRSO expedition photos are the property of IODP and are public access.

Some core photographs have been tonally enhanced to better illustrate particular features of interest. High-resolution images are available upon request.

Cover photograph shows the *JOIDES Resolution* navigating in the Subantarctic South Pacific Ocean close to Point Nemo. Photo credit: Christina Riesselman and IODP JRSO.

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Contents

Expedition reports

Chapters

[Expedition 383 summary](#)

G. Winckler et al.

[Expedition 383 methods](#)

G. Winckler et al.

[Site U1539](#)

G. Winckler et al.

[Site U1540](#)

G. Winckler et al.

[Site U1541](#)

G. Winckler et al.

[Site U1542](#)

F. Lamy et al.

[Site U1543](#)

F. Lamy et al.

[Site U1544](#)

F. Lamy et al.

Core descriptions

Visual core descriptions (VCDs) are presented in PDF files for each site. Smear slides and/or thin sections are presented in PDF and/or CSV files for each site and/or hole (CSV files are available in the CORES directory). The entire set of core images in PDF is available in the IMAGES directory.

[Site U1539](#)

[Visual core descriptions](#) · Smear slides

[Site U1540](#)

[Visual core descriptions](#) · Smear slides · [Thin sections](#)

[Site U1541](#)

[Visual core descriptions](#) · Smear slides · [Thin sections](#)

[Site U1542](#)

[Visual core descriptions](#) · Smear slides

[Site U1543](#)

[Visual core descriptions](#) · Smear slides · [Thin sections](#)

[Site U1544](#)

[Visual core descriptions](#) · [Smear slides](#)

Supplementary material

Supplementary material for the Volume 383 expedition reports includes geochemistry data in CSV and Microsoft Excel formats and DESClogik workbooks in Microsoft Excel format. A full list of directories can be found in SUPP_MAT in the volume zip folder or on the [Supplementary material for Volume 383 expedition reports](#) web page.

Expedition research results

Data reports

Titles are available in [HTML](#).

Syntheses

Titles are available in [HTML](#).

Drilling location maps

A site map showing the drilling locations for this expedition and maps showing the drilling locations of all International Ocean Discovery Program (IODP) expeditions, produced using QGIS (<http://www.qgis.org>), and all Integrated Ocean Drilling Program, Ocean Drilling Program (ODP), and Deep Sea Drilling Project (DSDP) expeditions, produced using Generic Mapping Tools (GMT) of Paul Wessel and Walter H.F. Smith (<https://www.generic-mapping-tools.org>), are available in PDF.

[IODP Expedition 383 site map](#)

[IODP map](#) (Expeditions 349–372, 374–376, and 379–383)

[Integrated Ocean Drilling Program map](#) (Expeditions 301–348)

[ODP map](#) (Legs 100–210)

[DSDP map](#) (Legs 1–96)

Dedication

The IODP Expedition 383 shipboard scientists dedicate this volume to Rolf Kilian, who passed away doing field work in Southern Patagonia during the early days of our expedition. Rolf's work in the Chilean fjords and off the coast of Chile was essential in developing our research plans for Chilean Margin Sites U1542 and U1544. Left: Rolf Kilian on board his Research Vessel *Gran Campo 2*. Photo credit: Helge Arz. Right: view from Site U1542 toward the Patagonian Mountains. Photo credit: Gisela Winckler.



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Special thanks to Captain Jake Robinson and the other ship officers and to Operations Superintendent Kevin Grigar for their thoughtful collaboration and outstanding handling of very challenging weather and sea conditions in the southern Pacific Ocean.

We thank Nicole Foucher who sailed as Chilean Coastal Observer and became a dedicated and highly productive member of the science party, helping out wherever support was needed. Muchas gracias to our observer extraordinaire.

Expedition 383 would not have been possible without the vision, dedication, and enthusiasm of all the proponents, including those who unfortunately could not sail with us. We acknowledge the support of R/V *Polarstern* Cruises PS75 and PS97; R/V *Marion Dufresne* Cruise Pachiderme, and the R/V *OGS Explora*. These expeditions provided the invaluable presite surveys under difficult weather and sea conditions.

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The Publications staff at the IODP *JOIDES Resolution* Science Operator at TAMU are thanked for help with the editing and publication of this volume. Finally, we thank the Science Evaluation Panel and the Environmental Protection and Safety Evaluation Panel for their support and advice in helping us develop the proposal into a successful expedition.

Foreword

The International Ocean Discovery Program (IODP) represents the latest incarnation of almost five decades of scientific ocean drilling excellence and is generally accepted as the most successful international collaboration in the history of the Earth sciences. IODP builds seamlessly on the accomplishments of previous phases: the Deep Sea Drilling Project, Ocean Drilling Program, and Integrated Ocean Drilling Program. The 2013–2023 IODP Science Plan (*Illuminating Earth's Past, Present, and Future*) defines four themes and thirteen challenges for this decade of scientific ocean drilling that are both of fundamental importance in understanding how the Earth works and of significant relevance to society as the Earth changes, at least in part in response to anthropogenic forcing. This phase of IODP represents an intense level of international collaboration in bringing diverse drilling platforms and strategies to increasing our understanding of climate and ocean change, the deep biosphere and evolution of ecosystems, connections between Earth's deep processes and surface manifestations, and geologically induced hazards on human timeframes.

The *Proceedings of the International Ocean Discovery Program* presents the scientific and engineering results of IODP drilling projects, expedition by expedition. As in the preceding Integrated Ocean Drilling Program, expeditions in the current IODP phase are conducted by three implementing organizations, each providing a different drilling capability. These are the US Implementing Organization (USIO; through September 2014) and the *JOIDES Resolution* Science Operator (JRSO; as of October 2014), providing the leased commercial vessel *JOIDES Resolution* for riserless drilling operations; JAMSTEC's Institute for Marine-Earth Exploration and Engineering (MarE3), providing the drillship *Chikyu* for riser and occasional riserless operations; and the European Consortium for Ocean Research Drilling (ECORD) Science Operator (ESO), providing "mission-specific" platforms (MSPs) for expeditions that extend the IODP operational range where neither drillship is suitable, for example, in polar environments and in shallow waters. Scheduling decisions for each capability are made by three independent Facility Boards, each of which includes scientists, operators, and platform funding partners: the *JOIDES Resolution* Facility Board (JRFB), *Chikyu* IODP Board (CIB), and ECORD Facility Board (EFB). At the beginning of the current IODP, the three Facility Boards agreed to utilize Publication Services at the USIO and now the JRSO for production of all expedition *Proceedings* volumes and reports.

The current IODP differs from prior scientific ocean drilling programs in that it has neither a central management organization nor commingled funding for program-wide activities. Yet this phase of IODP retains a fundamental integrative structural element: a "bottom-up" evaluation of all proposals for drilling expeditions by a single advisory structure composed of scientists representing all international program partners. International scientists may submit drilling proposals to the Science Support Office; all submitted proposals are then evaluated by a Science Evaluation Panel in the context of the Science Plan.

The current IODP also has a second internationally integrative level for high-level discussion and consensus-building: the IODP Forum. The Forum is not only charged with assessing program-wide progress toward achieving the Science Plan, but also with overseeing approaches toward a new bright future of scientific ocean drilling post 2023. At present, IODP involves 26 international financial partners, including the United States, Japan, an Australia/New Zealand consortium (ANZIC), Brazil, China, India, South Korea, and the eighteen members of ECORD (Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Israel, Italy, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the United Kingdom). This enhanced membership in the current IODP represents a remarkable level of international collaboration that remains one of the greatest ongoing strengths of scientific ocean drilling.

Dick Kroon
Chair, IODP Forum

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Lamy, F., Winckler, G., and Alvarez Zarikian, C.A., 2018. *Expedition 383 Scientific Prospectus Addendum: Dynamics of the Pacific Antarctic Circumpolar Current (DYNAPACC)*. International Ocean Discovery Program.

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Preliminary Report

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Winckler, G., Lamy, F., Alvarez Zarikian, C.A., Arz, H.W., Basak, C., Brombacher, A., Esper, O.M., Farmer, J.R., Gottschalk, J., Herbert, L.C., Iwasaki, S., Lawson, V.J., Lembke-Jene, L., Lo, L., Malinverno, E., Michel, E., Middleton, J.L., Moretti, S., Moy, C.M., Ravelo, A.C., Riesselman, C.R., Saavedra-Pellitero, M., Seo, I., Singh, R.K., Smith, R.A., Souza, A.L., Stoner, J.S., Venancio, I.M., Wan, S., Zhao, X., and Foucher McColl, N., 2021. Site U1541. In Lamy, F., Winckler, G., Alvarez Zarikian, C.A., and the Expedition 383 Scientists, *Dynamics of the Pacific Antarctic Circumpolar Current*. Proceedings of the International Ocean Discovery Program, 383: College Station, TX (International Ocean Discovery Program).

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Lamy, F., Winckler, G., Alvarez Zarikian, C.A., Arz, H.W., Basak, C., Brombacher, A., Esper, O.M., Farmer, J.R., Gottschalk, J., Herbert, L.C., Iwasaki, S., Lawson, V.J., Lembke-Jene, L., Lo, L., Malinverno, E., Michel, E., Middleton, J.L., Moretti, S., Moy, C.M., Ravelo, A.C., Riesselman, C.R., Saavedra-Pellitero, M., Seo, I., Singh, R.K., Smith, R.A., Souza, A.L., Stoner, J.S., Venancio, I.M., Wan, S., Zhao, X., and Foucher McColl, N., 2021. Site U1542. In Lamy, F., Winckler, G., Alvarez Zarikian, C.A., and the Expedition 383 Scientists, *Dynamics of the Pacific Antarctic Circumpolar Current*. Proceedings of the International Ocean Discovery Program, 383: College Station, TX (International Ocean Discovery Program).

<https://doi.org/10.14379/iodp.proc.383.106.2021>

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Lamy, F., Winckler, G., Alvarez Zarikian, C.A., Arz, H.W., Basak, C., Brombacher, A., Esper, O.M., Farmer, J.R., Gottschalk, J., Herbert, L.C., Iwasaki, S., Lawson, V.J., Lembke-Jene, L., Lo, L., Malinverno, E., Michel, E., Middleton, J.L., Moretti, S., Moy, C.M., Ravelo, A.C., Riesselman, C.R., Saavedra-Pellitero, M., Seo, I., Singh, R.K., Smith, R.A., Souza, A.L., Stoner, J.S., Venancio, I.M., Wan, S., Zhao, X., and Foucher McColl, N., 2021. Site U1543. In Lamy, F., Winckler, G., Alvarez Zarikian, C.A., and the Expedition 383 Scientists, *Dynamics of the Pacific Antarctic Circumpolar Current*. Proceedings of the International Ocean Discovery Program, 383: College Station, TX (International Ocean Discovery Program). <https://doi.org/10.14379/iodp.proc.383.107.2021>

Lamy, F., Winckler, G., Alvarez Zarikian, C.A., Arz, H.W., Basak, C., Brombacher, A., Esper, O.M., Farmer, J.R., Gottschalk, J., Herbert, L.C., Iwasaki, S., Lawson, V.J., Lembke-Jene, L., Lo, L., Malinverno, E., Michel, E., Middleton, J.L., Moretti, S., Moy, C.M., Ravelo, A.C., Riesselman, C.R., Saavedra-Pellitero, M., Seo, I., Singh, R.K., Smith, R.A., Souza, A.L., Stoner, J.S.,

Venancio, I.M., Wan, S., Zhao, X., and Foucher McColl, N., 2021. Site U1544. In Lamy, F., Winckler, G., Alvarez Zarikian, C.A., and the Expedition 383 Scientists, *Dynamics of the Pacific Antarctic Circumpolar Current*. Proceedings of the International Ocean Discovery Program, 383: College Station, TX (International Ocean Discovery Program). <https://doi.org/10.14379/iodp.proc.383.108.2021>

Supplementary material

Lamy, F., Winckler, G., Alvarez Zarikian, C.A., and the Expedition 383 Scientists, 2021. Supplementary material, <https://doi.org/10.14379/iodp.proc.383supp.2021>. Supplement to Lamy, F., Winckler, G., Alvarez Zarikian, C.A., and the Expedition 383 Scientists, *Dynamics of the Pacific Antarctic Circumpolar Current*. Proceedings of the International Ocean Discovery Program, 383: College Station, TX (International Ocean Discovery Program). <https://doi.org/10.14379/iodp.proc.383.2021>

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