Natural Resources Canada
Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 8920

Combined expedition report for 88ARGO, 90ARGO, 90CAPE_HATTERAS, 91ENDEAVOR, 94EDWIN_LINK, and 95EDWIN_LINK: University of Maine seismic reflection profiles collected in the Gulf of Maine, Maine, USA, and Nova Scotia, Canada

D.F. Belknap, B.J. Todd, R. Taylor, A. Kostylev, and C.A. Jarrett

2022

Canada

ISSN 2816-7155
ISBN 978-0-660-45348-4
Catalogue No. M183-2/8920E-PDF

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 8920

Combined expedition report for 88ARGO, 90ARGO, 90CAPE_HATTERAS, 91ENDEAVOR, 94EDWIN_LINK, and 95EDWIN_LINK: University of Maine seismic reflection profiles collected in the Gulf of Maine, Maine, USA, and Nova Scotia, Canada

D.F. Belknap[1], B.J. Todd[2], R. Taylor[3], A. Kostylev[3], and C.A. Jarrett[2]

[1]School of Earth and Climate Sciences, University of Maine, 5790 Bryand Global Sciences Center, Orono, Maine, USA
[2]Geological Survey of Canada, 1 Challenger Drive, P.O. Box 1006, Dartmouth, Nova Scotia
[3]RTAK Consulting, 335 Moirs Mill Road, Bedford, Nova Scotia

2022

© His Majesty the King in Right of Canada, as represented by the Minister of Natural Resources, 2022

Information contained in this publication or product may be reproduced, in part or in whole, and by any means, for personal or public non-commercial purposes, without charge or further permission, unless otherwise specified.
You are asked to:
- exercise due diligence in ensuring the accuracy of the materials reproduced;
- indicate the complete title of the materials reproduced, and the name of the author organization; and
- indicate that the reproduction is a copy of an official work that is published by Natural Resources Canada (NRCan) and that the reproduction has not been produced in affiliation with, or with the endorsement of, NRCan.

Commercial reproduction and distribution is prohibited except with written permission from NRCan. For more information, contact NRCan at copyright-droitdauteur@nrcan-rncan.gc.ca.

Permanent link: https://doi.org/10.4095/330704

This publication is available for free download through GEOSCAN (https://geoscan.nrcan.gc.ca/).

Recommended citation
Belknap, D.F., Todd, B.J., Taylor, R., Kostylev, A., and Jarrett, C.A., 2022. Combined expedition report for 88ARGO, 90ARGO, 90CAPE_HATTERAS, 91ENDEAVOR, 94EDWIN_LINK, and 95EDWIN_LINK: University of Maine seismic reflection profiles collected in the Gulf of Maine, Maine, USA, and Nova Scotia, Canada; Geological Survey of Canada, Open File 8920, 1 .zip file. https://doi.org/10.4095/330704

Publications in this series have not been edited; they are released as submitted by the author.

Table of Contents

1. Introduction……..…….3

2. Processing of analogue seismic data…….....3

3. Results……..……4

4. Access to digital information……..……..4

5. Acknowledgments……..……...6

6. References……..……6

List of Figures

Figure 1. Map of Gulf of Maine showing seismic survey lines of five expeditions…...…….…7

List of Tables

Table 1. List of expedition names……8

List of Appendices

Appendix 1: 88ARGO

1. Track plot of expedition 88ARGO in the Gulf of Maine
2. Expedition notes
3. Original navigation
4. GSCA formatted navigation
5. Seismic data inventory
6. Seismic profiles
7. Seismic profile detailed location maps showing start and end times

Appendix 2: 90ARGO

1. Track plot of expedition 90ARGO in the Gulf of Maine
2. Expedition notes
3. Original navigation
4. GSCA formatted navigation
5. Seismic data inventory

6. Seismic profiles
7. Seismic profile detailed location maps showing start and end times

Appendix 3: 90CAPE_HATTERAS

1. Track plots of expedition 90CAPE_HATTERAS in the Gulf of Maine (Huntec external and internal hydrophones)
2. Expedition notes
3. Seismic profiling cruise track log
4. Field notes from Daniel F. Belknap
5. Seismic data inventory
6. Seismic profiles (Huntec external and internal hydrophones)
7. Seismic profile detailed location maps showing start and end times (Huntec external and internal hydrophones)

Appendix 4: 91ENDEAVOR

1. Track plot of expedition 91ENDEAVOR in the Gulf of Maine
2. Expedition notes
3. Seismic profiling cruise track log
4. Daniel F. Belknap field book extract
5. GSCA formatted navigation (page 1 of 173 pages)
6. Seismic data inventory
7. Seismic profiles
8. Seismic profile detailed location maps showing start and end times

Appendix 5: 94EDWIN_LINK

1. Track plot of expedition 94EDWIN_LINK in the Gulf of Maine
2. Expedition notes
3. Original navigation
4. GSCA formatted navigation
5. Seismic data inventory
6. Seismic profiles
7. Seismic profile detailed location maps showing start and end times

Appendix 6: 95EDWIN_LINK

1. Track plot of expedition 95EDWIN_LINK in the Gulf of Maine
2. Expedition notes
3. Original navigation
4. GSCA formatted navigation
5. Seismic data inventory
6. Seismic profiles
7. Seismic profile detailed location maps showing start and end times

1. Introduction

From 1988 through 1995 geoscientists from the Department of Geology (now the School of Earth and Climate Sciences) of the University of Maine, and their scientific partners, undertook geoscientific studies in the Gulf of Maine in territorial waters of the United States of America and Canada (Fig. 1). This report, published by the Geological Survey of Canada (GSC), captures the metadata and marine geoscience information collected during these expeditions and describes how the information can be accessed on line. This capture of Gulf of Maine legacy seismic data is a contribution to the Open Geoscience strategic objective of the GSC, part of Canada's framework of Open Government.

The six expeditions have been assigned formal names following the naming protocols of the Geological Survey of Canada–Atlantic (Table 1). These formal names supersede all previous expedition names that readers may note in some of the scanned material included in Appendices 1 through 6.

The Gulf of Maine expeditions also collected geoscience data other than the seismic reflection profiles contained in this report. Sediment coring operations and locations are provided in the individual expedition reports provided in the appendices.

Questions about the Gulf of Maine marine geoscience data in general can be directed to Daniel F. Belknap, University of Maine, belknap@maine.edu.

Questions about the Gulf of Maine seismic reflection data processing can be directed to Brian J. Todd, Geological Survey of Canada, brian.todd@nrcan-rncan@gc.ca.

2. Processing of analogue seismic data

Seismic data were recorded using Eastern Daylight Time (EDT), which is Coordinated Universal Time (UTC) minus four hours. The navigation files published with this report (and available in digital format, see Section 4) are in UTC.

The following description outlines the steps used in processing from analogue rolled paper seismic records to digital images using software developed by Bob Courtney at the Geological Survey of Canada. All the software mentioned is available for download at: https://ftp.maps.canada.ca/pub/nrcan_rncan/raster/marine_geoscience/NRCAN%20Windows%2010%20Software

This software is the intellectual property of the Government of Canada. All rights to modify and distribute this software are retained by the Government of Canada.

Step 1
The rolled paper seismic records were scanned in greyscale at 300 dots per inch in JPEG 2000 (JP2) format. The greyscale scans were used as input into the seismic data processing software.

Step 2
Scanned seismic sections in JP2 format were registered using RegJP2000 (Courtney, 2012). Horizontal and vertical scales were applied. Vertical time shifts and/or changes in sweep rate were accounted for. The final step was to export sections into SEGY format.

Step 3
Program SegyJP2 was used to convert from SEGY format to JP2 format.

Step 4
Program SegyJp2Viewer was used to insert navigational data into the JP2 file. As a result the seismic profiles can be viewed and/or exported with the x axis representing trace number, time, or distance.

3. Results

A total of 4722 line kilometres of seismic reflection data were scanned and processed. It is instructive to compute the cost of collecting these data in 2022. To begin with, there is no Canadian government vessel available for undertaking such a survey. Therefore a survey vessel would have to be leased, either from private industry or a foreign government. A typical day rate for a capable survey vessel is approximately $70,000 Canadian. Such a vessel typically conducts geoscience sampling during daylight hours and geophysical surveys during nighttime hours, based on a geology crew and a geophysics crew working 12 hour shifts. Thus a maximum of 12 hours per survey day would be utilized to collect seismic reflection data. To optimize seismic reflection data quality, geophysical survey speeds are typically 7.4 km/hour (4 knots), resulting in about 90 km of data collection per 24 hour survey vessel day. Thus the 4722 line kilometres reported here represents 53 days of survey time for a cost of $3.7 million in 2022 dollars.

Appendices 1 through 6 provide individual expedition metadata and images of the processed seismic profiles. Access to the associated digital files associated with these images is described in Section 4.

4. Access to digital information

Scanned and processed digital versions of the seismic data (and the navigation files) described in this Open File report are available in JPEG 2000 (JP2) format for download from Natural Resources Canada at:

https://ftp.maps.canada.ca/pub/nrcan_rncan/raster/marine_geoscience/Seismic_Reflection_Scanned

The data are located in six subdirectories: 88ARGO, 90ARGO, 90CAPE_HATTERAS, 91ENDEAVOR, 94EDWIN_LINK AND 95EDWIN_LINK. Each of these subdirectories share the same overall subdirectory structure as described below.

JP2

- Processed seismic profiles with navigation inserted
- Use SegyJp2Viewer to view and manipulate these files (see software information below)

Navigation

- Original navigation files, GSC standard format navigation files (i.e., Year, Day of Year, Hour, Minute, Second, Latitude, negative Longitude), files of each individual survey lines suitable for importation into a Geographical Information System (i.e., dbf, prj, shp, shx files)

Profiles

- Graphic files of each processed seismic profile and the bathymetric profile corresponding to each seismic profile
- It is prudent to inspect the bathymetric profile corresponding to each seismic profile to ensure that the seafloor depths in both profiles are in agreement; this indicates that the seismic data processing has been correctly executed
- In the bathymetric profiles, the red line is derived from an in-house GSCA bathymetric compilation and the blue line corresponds to the GEBCO_2022 bathymetric compilation (https://www.gebco.net/data_and_products/gridded_bathymetry_data/); the two bathymetric profiles show general but not precise agreement

Registered JP2

- Using program RegJP2000, the scans of the original paper records are assigned horizontal and vertical scales

Unprocessed JP2

- These are the "raw", unprocessed scans of the original paper records

Waypoint Map

- Each seismic profile is illustrated on a local bathymetric map of the Gulf of Maine; the day and time of the start and end of the profile is labelled

It is strongly recommended that interested users of the Gulf of Maine seismic data download and install program SegyJp2Viewer in order to enjoy full manipulation capabilities of the JP2 digital data downloadable from the FTP site listed above. The viewer installation package can be downloaded from:

https://ftp.maps.canada.ca/pub/nrcan_rncan/raster/marine_geoscience/NRCAN%20Windows%2010%20Software/SegyJP2_Viewer

From this FTP site, download the file **SegyJp2_Viewer.msi** to a location of your preference on your hard drive. Then click on **SegyJp2_Viewer.msi** to perform the installation. Once installed, open the program and select the Add button on the upper left to add the JP2 file you wish to view. Then select View All in the upper centre. A detailed SegyJp2Viewer user manual is available through the "Help" button. It would greatly benefit users to be familiar with this manual to take advantage of the data display and output options.

If, for some reason, you are not able to access either the data or the software, please contact one or more of the Geological Survey of Canada–Atlantic staff listed below for assistance:

Calvin Campbell, Subdivision Head, Marine Environmental Geoscience, 902-426-4850, calvin.campbell@nrcan-rncan.gc.ca
Sheila Hynes, Geoinfomatics, 902-426-8355, sheila.hynes@nrcan-rncan.gc.ca
Bob Courtney, Senior Research Scientist, 902-426-5062, bob.courtney@nrcan-rncan.gc.ca
Kate Jarrett, Curator of the Marine Geoscience Collection, 902-426-6127, kate.jarrett@nrcan-rncan.gc.ca

The Gulf of Maine digital seismic profiles are available only from the FTP site given in this report. In the future, duplicated portions of the Gulf of Maine data described in this report (e.g., navigation files) also may be available from Natural Resources Canada's Expedition Database (ED) at https://ed.marine-geo.canada.ca and Physical Archive Database (PAD) at https://pad.marine-geo.canada.ca.

5. Acknowledgments

We thank the dedicated and professional research vessel captains and crews who facilitated the collection of these seismic data in the Gulf of Maine. We also thank the many contributing scientists and technical support staff who are listed in the individual expedition reports in the appendices. The valuable legacy seismic reflection data from the Gulf of Maine is a testament to their skill and dedication. Samantha King and Adam Skilton skillfully scanned the analogue records at the GSC–Atlantic office. Geneviève Philibert undertook a thorough review of the manuscript.

6. References

Courtney, R.C. 2012. RegJP2000 Version 2.0.Geological Survey of Canada, internal report, 50 p.

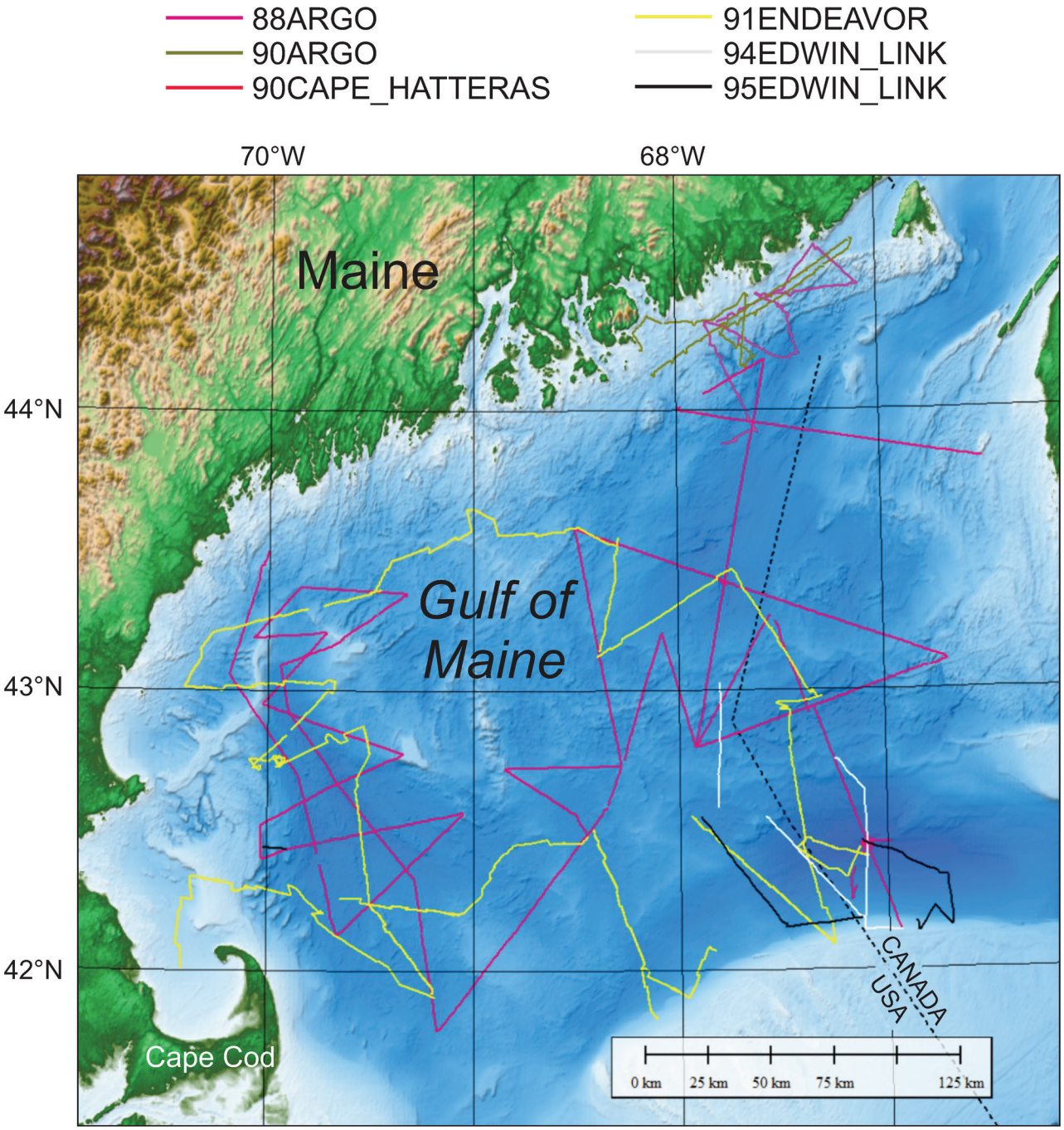

Figure 1. Map of Gulf of Maine showing seismic survey lines of six expeditions.

Table 1: List of expedition names.

Year	Vessel	Length Overall (m)	Original U of M identification	GSCA expedition name
1988	*R/V Argo Maine*	24.3	GM-88	88ARGO
1990	*R/V Argo Maine*		GM-90	90ARGO
1990	*R/V Cape Hatteras*	38	CH-10-90	90CAPE_HATTERAS
1991	*R/V Endeavor*	56	EN-226	91ENDEAVOR
1994	*R/V Edwin Link*	51	EL-94	94EDWIN_LINK
1995	*R/V Edwin Link*		EL-95	95EDWIN_LINK