

Preliminary cruise report

Cruise name/number: IODP Expedition 395: Reykjanes Mantle Convection and Climate/F2022-097

Authorizations:

Coastal State	Authorization Document Number	National Participant(s)
Greenland	Diplomatic Note Number: 2022-38303	None
Iceland	Diplomatic Note Number: UTN22110260/34.R.611	None

Scientist in charge of reporting:

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Brief description of scientific objective:

The objectives of International Ocean Discovery Program (IODP) Expedition 395: Reykjanes Mantle Convection and Climate (12 June 2023–17 August 2023), were to advance our understanding of mantle dynamics and the linked nature of Earth's interior, oceans, and climate.

The intersection between the Mid-Atlantic Ridge and Iceland hotspot provides a natural laboratory where the composition and dynamics of Earth's upper mantle can be observed. Plume-ridge interaction drives variations in the melting regime, which result in a range of crustal types, including a series of V-shaped ridges (VSRs) and V-shaped troughs (VSTs) located south of Iceland. Mantle upwelling beneath Iceland dynamically supports regional bathymetry and may lead to changes in the height of oceanic gateways, which in turn control the flow of deep water on geologic timescales.

IODP Expedition 395 and IODP Expedition 395C recovered basaltic samples from crust that is blanketed by thick sediments, that also contain climatic and oceanic records from modern to earliest Oligocene/late Eocene times. Major, trace, and isotope geochemistry of basalts from this expedition provide insight into spatial and temporal variations in mantle melting processes. These samples will enable testing of the hypothesis that the Iceland plume thermally pulses on two timescales (5–10 Ma and ~30 Ma), leading to fundamental changes in crustal architecture. This idea will be tested against alternative hypotheses involving propagating rifts and buoyant mantle upwelling.

Millennial-scale paleoclimate records are contained in the rapidly accumulated sediments of three contourite drifts cored during Expedition 395: Gardar, Björn, and Eirik drifts. The accumulation rate of these sediments is a proxy for current strength, which is moderated by dynamic support of

oceanic gateways such as the Greenland-Scotland Ridge. These sediments also provide constraints for climatic events including Miocene and Pliocene warmth, the intensification of Northern Hemisphere glaciation, and abrupt Late Pleistocene climate change.

The integrated approach of Expedition 395 allows the relationships between deep Earth processes, ocean circulation, and climate to be explored. These objectives were addressed by recovering 3826 m of sediment and basement cores from four sites during Expedition 395, plus an additional two sites which were completed during Expeditions 384 and 395C (U1555 and U1563). Two sites (U1554 and U1562) are located in Björn drift above a VSR/VST pair, and another site targeted the Holocene–Eocene sequence of sediments at Eirik drift, located on the eastern Greenland margin (U1602). The fourth site of Expedition 395 (U1564) is located on 32.4 My-old oceanic crust that is devoid of V-shaped features, and was chosen because it intersects the Holocene to Oligo–Miocene sedimentary sequence of Gardar drift.

Considered together, the sediments, basalts and vast array of measurements collected during Expedition 395 will provide a major advance in our understanding of mantle dynamics and the linked nature of Earth’s interior, oceans, and climate.

Update on anticipated dates for delivery of final results:	
Metadata:	With accordance to the application, the cores will be stored at the IODP Bremen Core Repository in Bremen, Germany for permanent storage.
Raw Data:	~ 21 January 2025
Processed Data:	~ 21 January 2025
Data Analysis:	~ 21 January 2025
WODC Data Registration (if applicable):	N/A

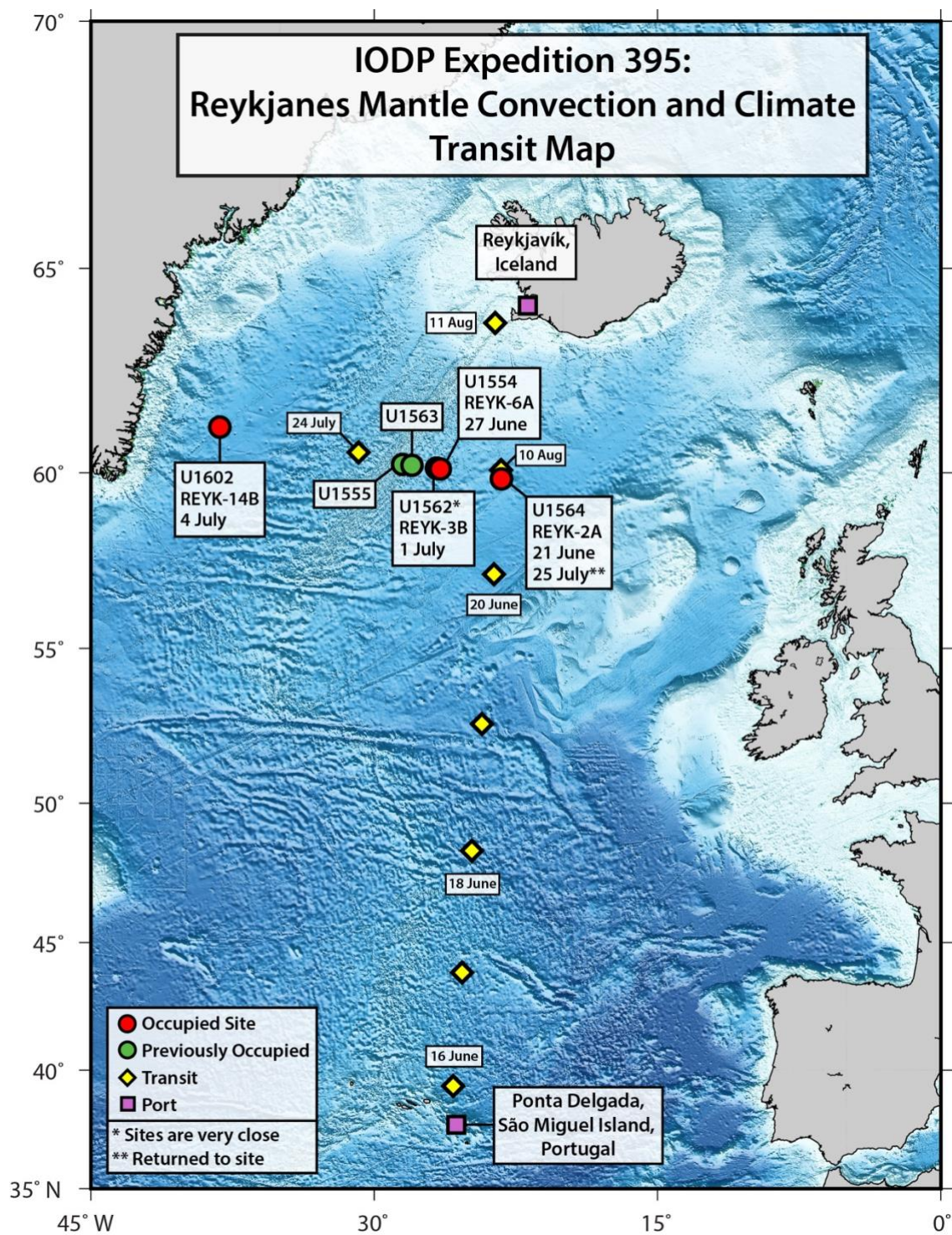


Figure 1. Transit Map for Expedition 395

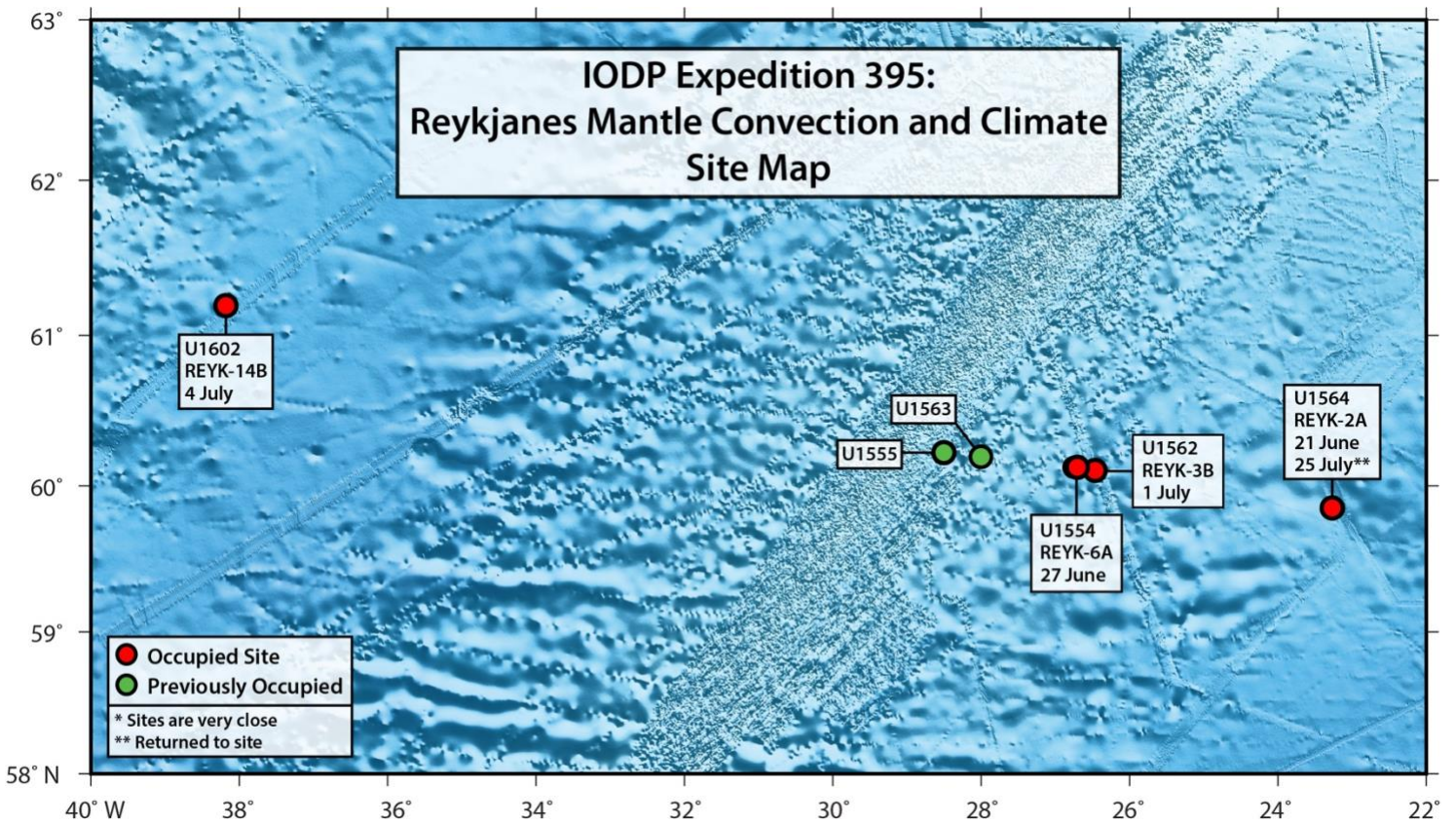


Figure 2. Site Map for Expedition 395

Table 1. Operations Summary of IODP Expedition 395

Hole	Latitude	Longitude	Water depth (mbsl)	Total penetration (mbsf)	Drilled interval (m)	Cored interval (m)	Recovered length (m)	Recovery (%)	Cores (N)	APC cores (N)	HLAPC cores (N)	XCB cores (N)	RCB cores (N)
U1554G	60°7.5037'N	26°42.1129'W	1868.7	355.0	0.0	355.0	362.29	102	40	31	3	6	0
U1554H	60°7.4952'N	26°42.1188'W	1866.7	354.9	0.0	354.9	370.10	104	38	30	0	8	0
Site U1554 totals:				709.9	0.0	709.9	732.40	103	78	61	3	14	0
U1562C	60°6.3015'N	26°30.0754'W	2002.8	300.4	7.0	293.4	308.45	105	48	15	33	0	0
Site U1562 totals:				300.4	7.0	293.4	308.45	105	48	15	33	0	0
U1564D	59°51.0483'N	23°16.0080'W	2208.1	657.3	2.0	655.3	632.42	97	73	22	6	45	0
U1564E	59°51.0485'N	23°15.9876'W	2207.3	263.5	0.0	263.5	273.70	104	28	22	0	6	0
U1564F	59°51.0363'N	23°15.9840'W	2208.1*	1169.7	598.0	571.7	434.15	76	75	0	0	0	75
Site U1564 totals:				2090.5	600.0	1490.5	1340.30	99	176	44	6	51	75
U1602A	61°11.7138'N	38°10.8186'W	2708.6	8.8	0.0	8.8	8.81	100	1	1	0	0	0
U1602B	61°11.7144'N	38°10.8184'W	2709.2	251.1	0.0	251.1	262.37	104	38	16	22	0	0
U1602C	61°11.7253'N	38°10.8193'W	2710.0	269.3	2.0	267.3	272.63	102	38	19	19	0	0
U1602D	61°11.7259'N	38°10.7967'W	2709.1	540.7	0.0	540.7	450.45	83	66	19	18	29	0
U1602E	61°11.7150'N	38°10.7961'W	2709.2	1365.2	529.3	835.9	450.39	54	87	0	0	0	87
Site U1602 totals:				2435.1	531.3	1903.8	1444.70	76	230	55	59	29	87
Expedition 395 totals:				5535.9	1138.3	4397.6	3825.80	84	532	175	101	94	162

Hole	Date started (2023)	Time started UTC (h)	Date finished (2023)	Time finished UTC (h)	Time on hole (days)	Time on site (days)
U1554G	27 Jul	1845	29 Jun	1745	1.96	
U1554H	29 Jun	1745	1 Jul	0645	1.54	
Site U1554 totals:						3.50
U1562C	1 Jul	1215	3 Jul	0900	1.86	
Site U1562 totals:						1.86
U1564D	21 Jun	1500	25 Jun	2015	4.22	
U1564E	25 Jun	2015	27 Jun	0640	1.43	
U1564F	25 Jul	2100	10 Aug	2200	16.04	
Site U1564 totals:						21.69
U1602A	4 Jul	1718	5 Jul	0500	0.49	
U1602B	5 Jul	0500	6 Jul	1600	1.46	
U1602C	6 Jul	1600	8 Jul	0530	1.56	
U1602D	8 Jul	0530	11 Jul	1645	3.47	
U1602E	11 Jul	1645	24 Jul	0409	12.48	
Site U1602 totals:						19.46
Expedition 395 totals:						46.51