IODP Expeditions 384/395C/395: Reykjanes Mantle Convection and Climate. Preliminary results

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International Ocean Discovery Program Expeditions 384, 395C and 395 investigated the interactions between variations in the Iceland hotspot activity, ocean crust formation at the Reykjanes Ridge, ocean circulation, and climate in the North Atlantic, and sediment drift deposition on the flanks of the mid-ocean ridge. Variations in crustal production along the Reykjanes Ridge produced V-shaped ridges and troughs located on the flanks of the mid-ocean ridge, and the role of the Iceland hotspot in their generation is debated. Changes in hotspot activity, and therefore in the associated dynamic topography, likely influenced the depth of the oceanic gateways formed by the Greenland-Scotland Ridge between the North Atlantic and the Norwegian and Arctic Seas. Such variations might thus have controlled the strength of cold, deep water currents, and the accumulation rate of sediment drifts on the flanks of the ridge: Björn and Gardar drifts on the eastern flank and Eirik drift to the west. Expeditions 384 in 2020, 395C in 2021, and 395 in 2023 collected cores from a transect of five drill sites along a plate-spreading flowline spanning seafloor ages from 2.8 to 32 Ma and crossing Björn and Gardar drifts on the eastern ridge flank, as well as a sixth site along the eastern Greenland margin crossing Eirik drift. Combined, over 400 m of oceanic basalt and over 5.8 km of sediment core was recovered, including continuous records through key Pleistocene and Pliocene sequences, and a unique record of progressive basalt alteration. Here we present preliminary results of the expedition, featuring new insights into crustal accretion variations through time, constraints on the onset of sedimentation at Björn, Gardar and Eirik contourite drifts, and new records of climatic cycles on thousand-year timescales. These sites also provide a unique view on how crust interacts with fluids and sediment over millions of years, while in-situ samples obtained from the cores yield insights into chemical exchanges and microbial systems in the ocean, sediment, and crust. The vast amount of sediments, basalts and measurements collected during Expeditions 384, 395C and 395 will provide a major advance in our understanding of mantle dynamics and the linked nature of Earth's interior, oceans, and climate.

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