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646-Full

IODP Proposal Cover Sheet

☒ **New** ☐ **Revised** ☐ **Addendum**

Please fill out information in all gray boxes *Above For Official Use Only*

Title:	Causes, origins and effects of fluctuations in the Iceland hotspot, North Atlantic		
Proponent(s):	Bryndis Brandsdittir, Anne Briais, Mathilde Cannat, Javier Escartin, David Graham, Barry B. Hanan, Emilie Hooft, John R. Hopper, Garrett Ito, Jian Lin, Dan Lizarralde, Bramley J Murton, Michel Rabinowicz, R.C. Searle, Matthew Thirlwall and Yang Shen		
Keywords: *(5 or less)*	Mantle, Hotspots, Dynamics, Magmatic variability	Area:	N. Atlantic

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Permission to post abstract on IODP-MI Sapporo Web site: ☒ Yes ☐ No

Abstract: (*400 words or less)*

Oceanic islands and plateaus provide strong evidence that significant fluxes of mass and energy are transferred from the Earth's interior to its surface by processes that are independent of the normal plate tectonic cycle. Whereas today, mid-ocean ridges account for ~95% of the mass and energy flux from the mantle, in the past, the contribution from hotspot volcanism has been as high as 50%. Such pulses of magmatism are implemented in climate change, mass extinctions, geomagnetic field anomalies and higher rates of seafloor spreading and hydrothermal activity, as well as continental break-up. Yet these pulses of excessive volcanism are episodic across a range of time scales. Characterizing these variations at a range of time and spatial scales, are essential to improving our insight into the mantle dynamics and Earth evolution.

In this proposal, we aim to explore the temporal evolution of the Iceland hotspot over the past 35 Ma. A nested suite of diachronous V-shaped ridges on the flanks of the Reykjanes Ridge provide one of the clearest, most systematic records of hotspot variability on Earth. By sampling along and across these V-shaped ridges, we will obtain a geochemical record necessary to test various hypotheses of the nature mantle flow along the Reykjanes Ridge and constrain to what degree the temporal variability is necessarily caused by changes in mantle volume flux, temperature, versus source composition.

Our proposal links directly to several decades of research into the Iceland phenomenon, and includes as co-proponents many of those past investigators. Our aims are identified as a high priority in the Initial Science Plan for IODP. Study of the Iceland-Reykjanes Ridge couplet is also recognised as a type example of hotspot-ridge interaction by the InterRidge community, from which this proposal has its origins. The outcome of this study will be a greater understanding of mantle hotspot dynamics, the causes of variation in composition and melting, and how it interacts with the steady-state plate tectonic cycle of the mid-ocean ridge system.

646-Full

Scientific Objectives: (*250 words or less*)

Our scientific objectives are to test several hypotheses for the origin of the Iceland hotspot, its fluctuation, evolution and mantle dynamics. Specifically, three models are considered:

1. That the Reykjanes Ridge is fed by shallow lateral mantle flow, originating from a narrow mantle plume beneath Iceland, and channeled by the sub-ridge lithosphere;
2. That the spreading ridge is fed by deep lateral flow of viscous mantle, also originating in a narrow mantle plume beneath Iceland;
3. That Iceland and its adjacent ridges are underlain by a much broader anomaly in upper-mantle composition, temperature and melting.

Please describe below any non-standard measurements technology needed to achieve the proposed scientific objectives.

Proposed Sites:

Site Name	Position	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
IR1	62°31'N; 25°48'W	885	90	60	150	sample basement at V-ridge V1.
IR2	62°34'N; 26°24'W	1152	200	60	260	sample basement at trough V1-V2.
IR3	62°37'N; 27°13'W	1415	150	60	210	sample basement at V-ridge V2.
IR4	62°39'N; 27°49'W	1482	275	60	335	sample basement at trough V2-V3.
IR5	62°40'N; 28°17'W	1604	210	60	270	sample basement at V-ridge V3.
IR6	62°41'N; 28°38'W	1722	325	60	385	sample basement at trough V3-V4.
IR7	62°44'N; 29°29'W	1949	270	60	330	sample basement at V-ridge V4.
IR8	62°49'N; 30°02'W	2113	400	60	460	sample basement at trough V4-V5.
IR9	62°50'N; 30°16'W	2196	330	60	390	sample basement at V-ridge V5.
IR10	63°14'N; 33°17'W	2856	1000	60	1060	sample orthogonal spreading crust.
IR11	64°00'N; 25°06'W	294	50	60	210	sample basement along crest of V-ridge V1.
IR12	63°35'N; 25°45'W	485	200	60	260	sample basement along crest of V-ridge V1.
IR13	62°06'N; 27°50'W	1467	140	60	200	sample basement along crest of V-ridge V1.
IR14	61°25'N; 28°52'W	1546	110	60	270	sample basement along crest of V-ridge V1.
IR15	60°14'N; 30°33'W	1639	90	60	150	sample basement along crest of V-ridge V1.
IR16	58°43'N; 32°30'W	1729	60	60	120	sample basement along crest of V-ridge V1.