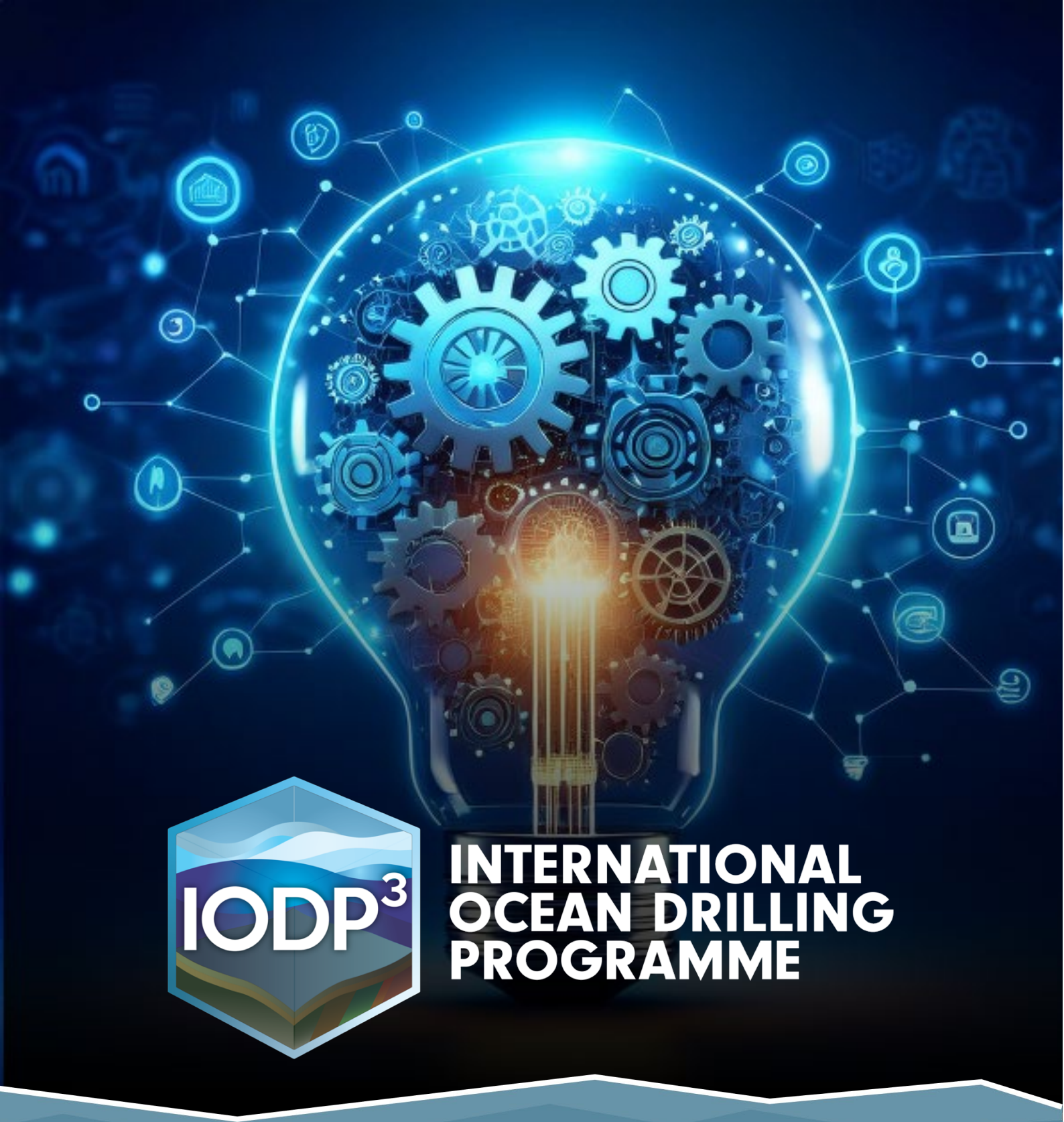

INTERNATIONAL OCEAN DRILLING PROGRAMME

# PROPOSAL 1124-PRE

## Charting the age of rifting across the Newfoundland Margin through drilling – CHARMING

# IODP$^3$ Proposal Cover Sheet

## Proposal Title:

Charting the age of rifting across the Newfoundland Margin through drilling – CHARMING

## Broad Geographic Area of the Proposal

North Atlantic southeast of Newfoundland

## Project Abstract

We propose scientific drilling with a Mission-Specific Platform across the Newfoundland Basin margin in the North Atlantic. Rifting leading to continental breakup and the formation of a new ocean basin is both a first-order tectonic process and the first step in **Strategic Objective 2** of the International Ocean Drilling Programme (IODP$^3$) ***2050 Science Framework*** (“**Oceanic Life Cycle of the Tectonic Plates**”) coming under the heading **Continental Breakup and New Ocean Basins** and the subheading “**Fundamental rifting modes**”. As the ocean basins cover two thirds of the Earth’s surface, the rifting that leads to them is one of the most important tectonic processes on Earth.

A key aim of Strategic Objective 2 of the SF2050 is how rifting progresses to continental breakup. Over the years, the discussion has boiled down to two opposing hypotheses: either the rifting and faulting migrate asymmetrically into one side of the early rift, or the rifting focuses at the centre of that early rift. The key to distinguishing between these models is accurate dating of the timing of slip on individual faults across the rift, which can only be achieved by sampling via drilling followed by dating using microfossils. The sites across the Newfoundland margin will complement those from past drilling of the deep margin there (ODP Leg 210, Sites 1276 and 1277), completing a transect across the Newfoundland margin, and through the extensive sampling on the conjugate Iberian margin (ODP Legs 103, 149, 173), also completing a transect across the entire type-example magma-poor rift system.

This pre-proposal sets out the scientific rationale for drilling across the Newfoundland margin but will need reprocessing of selected seismic data to finalise the drilling plan. It is however anticipated that there will be an Essential Plan (3 sites with <3000m drillstring), an Intermediate Plan (5 Sites) and an Advanced Plan (7 Sites).

## Scientific Objectives

Our overarching aim is to target the synrift of the necking zone. If rifting focused with time, we would expect the oldest synrift across the margin to be the same age, but with younger synrift towards the deep margin (Site 1276) where extension focused to breakup. On the other hand if extension and faulting migrated asymmetrically towards the line of eventual breakup, we would expect the age of the **oldest synrift to also be diachronous**, younging towards the ocean, the line of eventual breakup. The expected results from these models are shown in Figure 4. Only by determining the timing of fault slip across the whole margin will we be able to unravel the rift history and so understand how extension proceeded to breakup. We will test models for rifting to breakup by addressing three specific, achievable objectives:

1 Sampling through drilling the youngest and oldest synrift sediments at various points across the margin. Only by drilling can we reach through the overlying postrift section to sample the underlying synrift.
2 Determining the age of these synrift sediment packages through micropaleontology and/or by magnetostratigraphy as appropriate. By dating syn-faulting sediment we will date fault activity
3 Combining the results from the proposed drilling with that of previous drilling (Legs 149, 173 on the Iberia margin and 210 on the Newfoundland margin) to construct the complete rift history across the developing rift

## Science Communication Plain Language Summary

The ocean basins that form two thirds of the Earth’s surface develop when continents split and move apart (continental breakup). In so doing, not only are new ocean basins formed but also gateways between existing oceans open, affecting global oceanic circulation and climate. The mechanism of breakup is however not well understood: in some cases breakup is accompanied by voluminous magmatism, in other much less. The first step in understanding that process is to understand the when, how and how quickly the continent split, which requires accurate dating of the timing of slip on the main fault systems across the margin.