Instruments and Methods

Modelling the local distribution of cold-water corals in relation to bathymetric variables: Adding spatial context to deep-sea video data

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ARTICLE INFO

ABSTRACT

Video data and high-resolution multibeam bathymetry were acquired using a Remotely Operated Vehicle (ROV) on the flank of a carbonate mound (~850 m depth) in the Porcupine Seabight, SW Ireland. The ROV-mounted multibeam system revealed details of bathymetry that were not resolved by ship-borne multibeam survey, but appear to be important in structuring the distribution of the cold-water corals *Lophelia pertusa* and *Madrepora oculata*. Quantitative measures of slope, orientation, roughness and curvature were calculated from the ROV multibeam bathymetry data across a range of spatial scales. These parameters were analysed for their ecological relevance to the distribution of the corals and used in an Ecological Niche Factor Analysis (ENFA) to identify the most suitable areas for coral colonisation within the extent of our ROV multibeam data. The suitability map covers an area nine times the size of the area imaged directly by video. Cross-validation of the results with video data indicates that the predictions are reliable. This combined survey and modelling approach offers a comprehensive method for ground-truthing discrete seabed features such as mounds. It provides spatial context to high-resolution deep-water video observations and highlights the importance of bathymetric variables in influencing coral distribution.

1. Introduction

Offshore mapping programmes such as the Irish National Seabed Survey (INSS) now commonly employ multibeam surveys to acquire bathymetry and acoustic backscatter data in deep water, beyond the continental shelf. The primary motivation for acquiring these data is often for broad-scale applications, including delimitation of national territories or hydrographic surveys. However, multibeam data have also proven invaluable for geological mapping (Todd et al., 1999), the mapping of general (Kostylev et al., 2001) and specific benthic habitats, e.g.,

cold-water corals (Fosså et al., 2005; Roberts et al., 2005) and can assist in the management of living resources (Kostylev et al., 2003). Besides revealing the general morphology of Ireland's offshore territory in unprecedented detail, the INSS multibeam survey (GOTECH, 2002) has identified many discrete morphological features, such as mounds, gullies and canyons. These represent anomalies in the general ecological gradients of the continental slope, and require targeted ground-truthing to determine their ecology and surficial geology.

On the Irish continental slope, some of the most prominent discrete features mapped to date are carbonate mounds. Recent evidence from shallow cores and deep drilled cores (IODP Expedition Scientists, 2005; Roberts et al., 2006; Rüggeberg et al., 2007) has shown that these mounds are built from successive periods of interglacial coral growth with intervening periods of glacial deposits. They range in size from less than 1 km to several km diameter (Fig. 1) and are of special ecological interest

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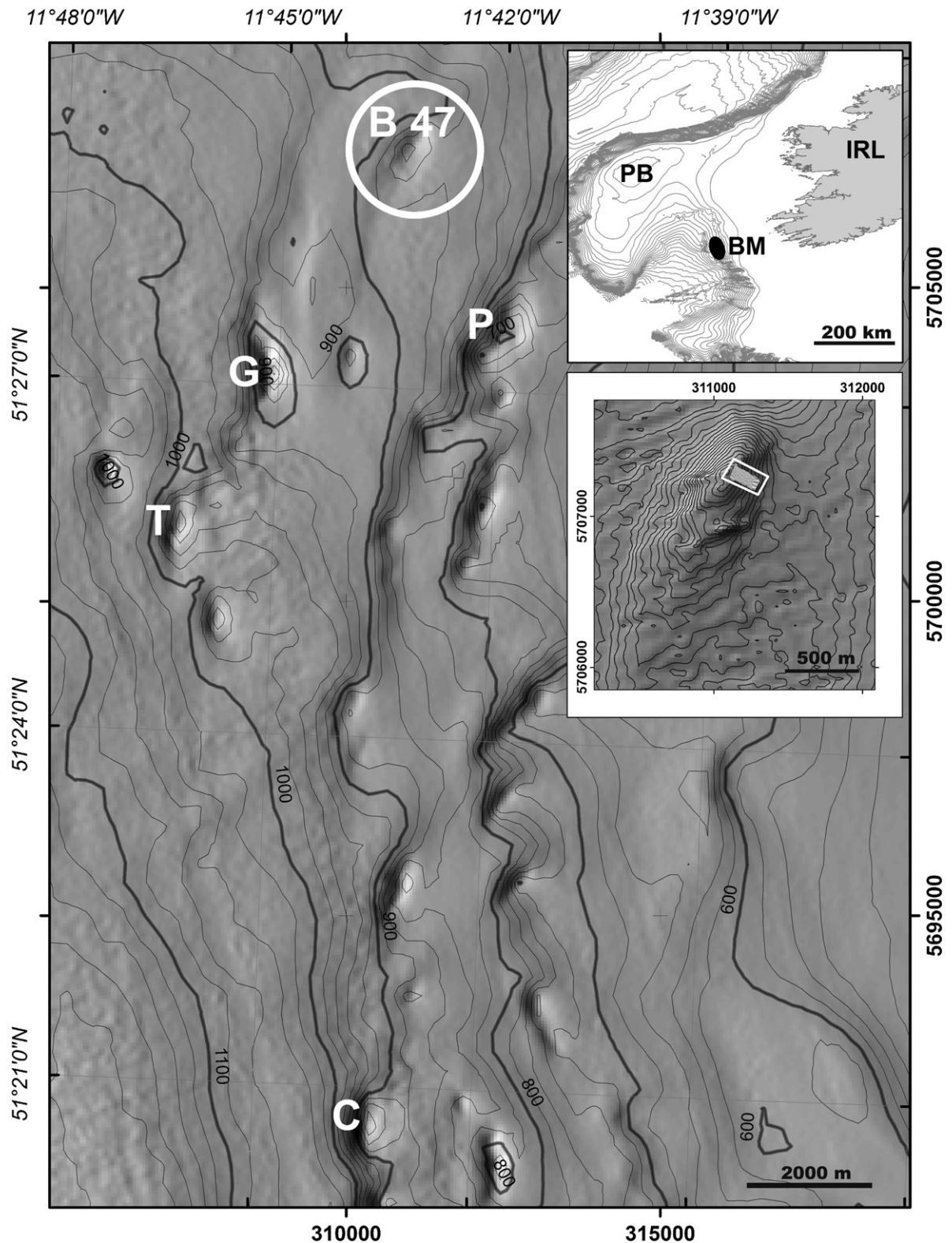
Fig. 1. The study area in the Belgica Mound province, Porcupine Seabight, SW Ireland. The position of the case-study mound BEL 47 (B 47) is shown in relation to some of the other better-known mounds in the province—Thérèse Mound (T), Galway Mound (G), Poseidon Mound (P), and Challenger Mound (C). Projected view (UTM Zone 29N (WGS84)) with geographic (WGS84) coordinates indicated for reference. Inset maps show the general location offshore Ireland (geographic view-WGS84) and the approximate location of the ROV dataset on BEL 47 (projected view UTM 29N, (WGS84)).