Development of coral banks in Porcupine Seabight: do they have Mediterranean ancestors?

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Abstract. This paper presents an overview of the spatial distribution and morphology of coral banks in the Porcupine Seabight in relation to their environmental settings. The study area is characterised by well-delimited clusters of coral banks, each featuring typical bank morphology and environmental setting. In the central part of the basin, two mound provinces can be identified: a set of complex flat topped seafloor mounds in the Hovland Mound province is flanked to the north by a crescent of numerous north-south elongated buried coral banks in the Magellan Mound province, along the eastern margin of the basin partly buried and seabed coral banks represent the Belgica Mound province. The banks are mound-shaped elevations, many of them hosting living deep-water corals (Lophelia pertusa, Madrepora oculata, Desmophyllum cristagalli, Dendrophyllia sp.) and associated fauna. This active biological layer covers a dead assemblage of corals clogged with mud. All coral banks, buried or seabed, occur in association with current-induced features (e.g., scouring features, dunes) and steep palaeo- and present-seabed slopes. Only a few banks have a present-day seabed expression, which suggests that environmental conditions have been more favourable for bank development in the past. The depth range of the seabed coral banks coincides with the Mediterranean Outflow Water which may control indirectly the coral distribution. The distribution of corals in the southern part of the North Atlantic and the actual link with Mediterranean water suggest a possible migration of corals within the Mediterranean water along the NE Atlantic margin. The start-up phase of the coral bank development in the basin has taken place simultaneously for all provinces, and tentatively framed in times subsequent to a Late Pliocene period of erosion and non-deposition. It is considered that the sedimentary load of the currents plays an important role in the bank development. Coral banks accrete by the active baffling of sediment by the biological framework and growth of the biological cap. When sedimentation and biological growth get out of balance, the framework will progressively be clogged.
with sediment. Once sediment dominates the structure the coral banks get buried and draped by sediment.

**Keywords.** Cold-water corals, coral banks, Porcupine Seabight, Mediterranean Sea, Atlantic Ocean, Mediterranean Outflow Water

**Introduction**

The presence of deep-water corals in the Northeast Atlantic is considered to be closely related to certain oceanographic conditions favourable for the azooxanthellate corals, for which nutrient supply, current activity, and slow sedimentation rates are the most important controlling parameter, besides a hard substratum to settle on (Stetson et al. 1962; Cairns and Stanley 1981; Mullins et al. 1981; Frederiksen et al. 1992; Mortensen et al. 1995; Freiwald et al. 1999). Coral banks are less common than coral patches and appear in clusters along the Atlantic margins (Henriet et al. 1998; De Mol 2002; Freiwald 2002; Huvenne et al. 2003; Kenyon et al. 2003; O’Reilly et al. 2003; van Weering et al. 2003).

The Porcupine Seabight is known for its unique set of seabed and buried mound provinces associated with deep-water scleractinian corals. The patchy distribution of these large biological build-ups had intrigued scientists since their discovery and has led to several genetic models (Hovland et al. 1994; Henriet et al. 2001; De Mol 2002). The paper of Hovland et al. (1994) has brought deep-water coral banks in the Porcupine Seabight, southwest of Ireland, in the spotlights of deep-water ecosystem research. These authors had identified some 33 dome-like seabed mounds on conventional 2D exploration seismic profiles, in the central part of the Porcupine Basin. Sediment samples on the mounds yielded the deep-sea coral *Lophelia pertusa*, besides mud.

Later seismic surveys in the same basin have revealed three well-delineated mound provinces along the central and eastern margin of the Porcupine Basin (Fig. 1), each characterised by their geometry and environmental setting (Henriet et al. 1998; De Mol et al. 2002; Huvenne et al. 2003; Van Rooij et al. 2003).

The central part of the basin is characterised by complex flat-topped seafloor mounds in the Hovland Mound province surrounded to the north by numerous buried mounds in the Magellan Mound province. Along the steep eastern margin of the basin partly conical, both buried and seabed mounds represent the Belgica Mound province (Henriet et al. 1998; De Mol et al. 2002, Huvenne et al. 2003; Van Rooij et al. 2003). The banks are mound-shaped elevations, hosting living deep-water scleractinian coral (*Lophelia pertusa, Madrepora oculata, Desmophyllum cristagalli, Dendrophyllia sp.* and associated fauna. This active biological layer covers a dead assemblage of corals clogged with mud (De Mol et al. 2002). In the Belgica Mound province the live coral is more disseminated than in the Hovland Mound province (e.g., Thérèse Mound; De Mol et al. submitted) and also corals seem to stabilise sand dunes in between the large Belgica Mounds, forming smaller structures known as the Moira Mounds (Wheeler et al. 2005).