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Tectonic control on sedimentary dynamics in intraplate oceanic settings: A geomorphological image of the eastern Canary Basin and insights on its middle-upper Miocene to quaternary volcano-tectonic-sedimentary evolution

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ABSTRACT

This paper integrates sedimentary, tectonic and volcanic geological processes inside a model of volcano-tectonic activity in oceanic intraplate domains related to rifted continental margins. The study case, the eastern Canary Basin (NE Atlantic), is one of the few places in the world where giant MDTs and Quaternary volcanic and hydrothermal edifices take place in intraplate domains. In this paper, we analyse how two structural systems (WNW-ESE and NNE-SSW) matching with the oceanic fabric control the location of volcanic systems, seafloor tectonic reliefs and subsequently the distribution of main sedimentary systems. Linear turbidite channels, debris flow lobes and the lateral continuity of structural and volcanic reliefs follow a WNW-ESE trend matching the tracks of the oceanic fracture zones. Furthermore, escarpments, anticline axes and volcanic ridges follow a NNE-SSW trend matching normal faults delimiting blocks of oceanic basement. The morpho-structural analysis of all the above geomorphological features shows evidence of a volcanic and tectonic activity from the middle–upper Miocene to the Lower–Middle Pleistocene spread over the whole of the eastern Canary Basin that reached the western Canary Islands. This reactivation changes the paradigm in the seamount province of Canary Islands reported inactive since Cretaceous. A tecto-sedimentary model is proposed for this period of time that can be applied in other intraplate domains of the world. A tectonic uplift in the study area with a thermal anomaly triggered volcanic and hydrothermal activity and the subsequent flank collapse and emplacement of mass transport deposits on the Western Canary Slope. Furthermore, this uplift reactivated the normal basement faults, both trending WNW-ESE and NNE-SSW, generating folds and faults that control the location of turbidite channels, escarpments, mass transport deposits and volcanic edifices.

1. Introduction

Deep seafloor areas are poorly surveyed. In the las decade, the high-resolution geological knowledge of deep-water areas in oceanic intraplate domains have been the objective for several researches focused on geohazards (Geersen et al., 2015), critical metallic elements (Marino et al., 2017; Geersen et al., 2015), energy resources (e.g. H_2 and hydrocarbons; Dabson et al., 2016) and fragile extremophile chemosynthetic ecosystems (Hensen et al., 2015).

MTDs have been intensively studied in deep-waters as geohazards (Harbitz et al., 2006) and energy reservoirs and stores (Cox et al., 2020; Madrussani et al., 2018). Giant submarine landslides sourced in continental areas are often channelled to the adjacent oceanic seafloor areas as in the Bay of Bengal (Curray et al., 2002), the Norwegian margin (Evans et al., 2005), Canary Islands (Hunt and Jarvis, 2017; León et al., 2019) and the northwest African margin (Krastel et al., 2019). In the case of the Bay of Bengal, oceanic fracture zones control dynamic and location of MDTs in the oceanic domain (Levchenko and Verzhbitskii, 2005). In volcanic ocean islands, periods of intense volcanic activity have been proposed as the most important mechanism generating main

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