Seafloor giant polygons associated with underlying polygonal faults in the Caribbean Sea, west of Grenada Basin

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To cite this version:


HAL Id: hal-02384501
https://hal.archives-ouvertes.fr/hal-02384501
Submitted on 28 Nov 2019

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Seafloor giant polygons associated with underlying fault systems in the Caribbean Sea, west of Grenada Basin

1. INTRODUCTION

During the Cruise G3 in May-June 2017, giant polygons have been identified on the seafloor of the Caribbean Sea, in the western part of Grenada Basin. They are directly related to current active polygonal faults which usually form in fine-grained, clay-rich sediments (Cartwright, 1999; Clausen et al., 1999). Such fault systems have been recognized in many basins worldwide (Clausen et al., 1999; Neagu et al., 1998; Neagu and Mercier De Lepinay, 2001). The polygons are similar to those found in the lower continental shelf of the Gulf of Mexico (Cartwright and Loneragan, 1997) and have been described in the Gulf of St. Lawrence (Cartwright, 1994). These systems are typically associated with specific regional characteristics, such as sedimentary environments and tectonic settings.

2. PROCESSES

Polygons are believed to be formed through the interaction of several processes, including tectonic activity, sedimentation, and fluid expulsion. During the Garan’s Cruise in May-June 2017, giant polygons have been identified on the seafloor of the Caribbean Sea, in the western part of Grenada Basin. All of these basins are characterized by a similar sedimentary environment suggesting that the polygonal fault systems could have formed through equivalent processes.

3. ARCHITECTURE

In the northern part, west of Guadeloupe, the seabed polygons are much wider by a factor of 10 to 20% (Figure 2B). The polygons are separated by an absence of polygonal furrows, representing 25 to 40 m in real depths (Figure 1B). The comparison between the furrows on the seafloor and the furrows on the regional seismic data at a basin scale provides new insights on a margin history and improves the understanding of the complex interaction between the polygonal fault systems and the overlying sedimentary environment.

4. INTERPRETATION

The presence of active polygonal faults on the seafloor has important implications for the understanding of the tectonic and sedimentary processes in the region. The polygons are typically associated with specific regional characteristics, such as sedimentary environments and tectonic settings. This system is characterized by a series of concentric polygonal furrows that are 800 to 1500 m wide and 40 m deep compared to the smooth regional slope (Figure 3A). Very high amplitude reflections are vertically stacked and the depression is increasing towards the seabed. This could be due to the upward propagation of the polygonal fault system along the basin.

5. REFERENCES

- Cartwright, A. Gay, C. Baudon, C. Berndt, R. Soliva, S. Planke, R. Mour, 2018. Giant polygons, 1 to 5 km wide, have been identified on the EM122 multibeam data (Figure 1A). The polygons are separated from the underlying sediments by a 700 to 900 m thick interval and they reach the modern seafloor where they bound polygonal furrows visible on multibeam data. The polygons are associated with underlying polygonal faults in the Caribbean Sea, west of Grenada Basin on the Norwegian continental margin. All of these basins are characterized by a similar sedimentary environment suggesting that the polygonal fault systems could have formed through equivalent processes.

- Within the basin, there are no significant changes in the horizontal length and shear planes represent an apparent extension. The consequences of these changes are: (1) the apparent extension; (2) the apparent extension along the shear planes; and (3) the apparent extension along the shear planes. In the northern part, west of Guadeloupe, the seabed polygons are much wider by a factor of 10 to 20% (Figure 2B). In the northern Danish Central Trough (Clausen & Korstgard, 1993) in the Eromanga Basin (Cartwright & Loneragan, 1997) in the Gulf of St. Lawrence (Cartwright, 1994) and in the Rockall Trough in Ireland, or in the Voring Basin on the Norwegian continental margin. All of these basins are characterized by a similar sedimentary environment suggesting that the polygonal fault systems could have formed through equivalent processes.

- The presence of active polygonal faults on the seafloor has important implications for the understanding of the tectonic and sedimentary processes in the region. The polygons are typically associated with specific regional characteristics, such as sedimentary environments and tectonic settings. This system is characterized by a series of concentric polygonal furrows that are 800 to 1500 m wide and 40 m deep compared to the smooth regional slope (Figure 3A). Very high amplitude reflections are vertically stacked and the depression is increasing towards the seabed. This could be due to the upward propagation of the polygonal fault system along the basin. That the complex interaction between the polygonal fault systems and the overlying sedimentary environment can lead to an increase in the rate of sea-level change and the formation of new landforms.