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

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3 INTRODUCTION

During the Quaternary, the Caribbean Sea is a tectonically active area where large-scale faulting processes occur. This has led to the formation of polygonal fault systems, which are characterized by a network of polygonal fractures and associated sedimentary features. These systems are commonly associated with underlying fault-related deformation zones. In this study, we present new geophysical data obtained during the Béton Bleu project, a joint Franco-Mexican scientific mission that took place in the Caribbean Sea west of Grenada Basin. The objectives of this study were to investigate the relationship between polygonal faults and underlying fault systems, and to understand the processes involved in their formation and evolution.

4 PROCESSES

Polygonal systems are known to form in various tectonic environments, such as in extensional settings or during shear deformation. In this study, we focus on the processes involved in the development of polygonal faults in the Caribbean Sea. The main processes identified are:

- Syneresis of colloidal sediments (Dewhurst et al., 2000), which is the process by which water is expelled from a colloidal suspension under the influence of stress.
- Inversion and gravity collapse (Watson et al., 2000), which occurs when a sedimentary sequence is inverted due to gravity, leading to the formation of polygonal patterns.
- Faulting controlled by residual shear strength and low cohesion (Scherer, 1986; Van Vliet et al., 1991), which leads to shrinkage in mud-dominated sequences (Cartwright & Lonergan, 1996; Dewhurst et al., 1999). The development of polygonal fault systems seems highly dependent on a combination of these processes.

5 ARCHITECTURE

In the northern part, west of Grenada Basin, the seabed polygons are much wider by a factor of 10 to 20% (Figure 2A), while in the southern part, they are narrower. This difference in width could be due to variations in tectonic stress or sediment input. In both areas, the polygons are characterized by a network of polygonal fractures and associated sedimentary features. These systems are commonly associated with underlying fault-related deformation zones. In this study, we present new geophysical data obtained during the Béton Bleu project, a joint Franco-Mexican scientific mission that took place in the Caribbean Sea west of Grenada Basin. The objectives of this study were to investigate the relationship between polygonal faults and underlying fault systems, and to understand the processes involved in their formation and evolution.

6 INTERPRETATION

In the northern part, west of Grenada Basin, the seabed polygons are much wider by a factor of 10 to 20% (Figure 2A), suggesting that the polygonal fault systems are controlled by underlying fault systems. In the southern part, the polygons are narrower, indicating that the polygonal fault systems are controlled by different processes. The presence of polygonal faults in the Caribbean Sea is indicative of tectonic activity and the movement of Earth's crust. These faults play an important role in the transfer of mechanical energy from the Earth's surface to the subsurface, leading to the formation of sedimentary structures and features. The study of polygonal faults is crucial for understanding the tectonic history of the Caribbean Sea and the evolution of its sedimentary sequences.