High-Frequency Evolution of Cap Lopez Canyon (Gabon) from Annual Bathymetric Data

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Sandbodies located on inner bends of meanders within deep-sea channels can form important hydrocarbon reservoirs and are of significant interest to the hydrocarbon industry. However, little is known about their forming processes and their conditions of preservation. This poor understanding is in part due to the lack of high resolution geo-acoustic data. The study of the Cap Lopez canyon, located on the Gabonese margin (West Africa) is a key example to understand the morphological evolution of submarine channels and their associated deposits. This paper focuses on the high resolution evolution of this canyon on annual and multi-decennial scales, using time serial bathymetric data acquired from 1959 to 2009.

Our results show similar rate (2-16 m/year) and way of migration to those observed in rivers, suggesting that the Cap Lopez canyon may be subject to very quick morphological evolutions. The lateral migration of the thalweg at an annual scale is characterized by predominant progressive lateral migration and catastrophic chute cutoffs related to gravity flows generated during intense meteorologic events. It suggests that lateral migration through time follows a linear evolution toward the development of a meandering system (multi-decennial scale) which is the result of high frequency fluctuations (annual scale). The lateral migration of the thalweg is performed continuously through the erosion on the outer bank and depositional processes on the opposite bank. This study reveals that the progressive erosion by gravity flows is predominant compared to the establishment of large events such as mass wasting. The erosion of the outer bends probably results in the combined action of the erosive behaviour of gravity flows with reversal helical flow dynamic. Finally, the comparison of the bathymetric data allowed to define several types of terraces corresponding to the different degrees of maturity of the canyon and to evaluate their life span.

Based on a detailed analysis of time serial bathymetric data, our study evaluates for the first time the frequency and the degree of importance of short term sedimentary processes responsible for the lateral migration and meander development. This innovative approach may be of significant interest in order to understand and eventually predict the geometry of lateral accretion packages.

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