Introduction

The genesis of the Uruguayan Continental Margin (UCM) is associated with the fragmentation of West Gondwana and subsequent Atlantic opening, which started during the Upper Jurassic. Three sedimentary basins are recognized in the UCM: Punta del Este, Pelotas (Southern portion), and Oriental del Plata (Fig. 1), being the Orange Basin its analogue in the conjugated margin. The UCM is highly heterogeneous both longitudinally and perpendicularly, suggesting its complex geological history. In that context, its central sector (corresponding to the transition zone between the Punta del Este and Pelotas basins) exhibits outstanding characteristics that make it an important region for understanding the South Atlantic opening processes and the evolution of the margin during the rift phase and the early stages of continental drift. Among the most significant features are the interruption of SDRs (seaward dipping reflectors), the dislocation of magnetic and gravity anomalies and depocenters, hyper-thinning of continental crust, and the occurrence of a transitional "magmatic" crust not represented by SDRs. These characteristics have been linked, in whole or in part, to a short-lived triple junction during the early stages of Gondwana fragmentation (Conti et al., 2021; Thompson et al., 2018), the development of a pull-apart basin in a transtensional tectonic context (Rowlands et al., 2016), and the occurrence of the Rio de la Plata Transfer System (RPTS) (Soto et al., 2016). The central sector of the UCM is analyzed in this study, for the period between the Atlantic rifting and the early stages of the continental drift.

Geological Setting

According to Moulin et al. (2010), the UCM develops south of the Walvis/Rio Grande ridge in the Atlantic Ocean's southern segment. The continental breaks up began in the south, approximately 138 Ma ago (Heine et al., 2013), being one of its most notable features the emplacement of the SDRs on the continent-ocean transition, that indicates remarkable volcanic activity (e.g., Geoffroy, 2005; Stika et al., 2014; Chauvet et al., 2021). Another distinctive aspect of the south segment's western side is the development of basins perpendicular to the margin, with usual orientations NW-SE/E-W, the northernmost of them (Cuenca Punta del Este) is in the UCM (Franke et al., 2006). The UCM constitutes a volcanic-passive margin that is segmented by the RPTS, and it is characterized by the presence of thick SDR and volcano-sedimentary depocenters with thicknesses that exceed 7 km in some sectors (Chauvet et al., 2021; Morales et al., 2017; Soto et al., 2011; Franke et al., 2007) (Fig. 1).

Database and Methodology

To conduct this work, geological and geophysical information from the three exploratory wells drilled in the UCM (Lobo, Gaviotín, and Raya, Fig. 1) as well as 2D and 3D high-resolution seismic data acquired between 2012 and 2014 were utilized. The workflow was represented by the following activities: a) fault mapping; b) interpretation of key seismic horizons, including the Mohorovic discontinuity (Moho); top prerift, base and top of the Barremian-Aptian sequence; and c) assembling of structural and isopach contour maps

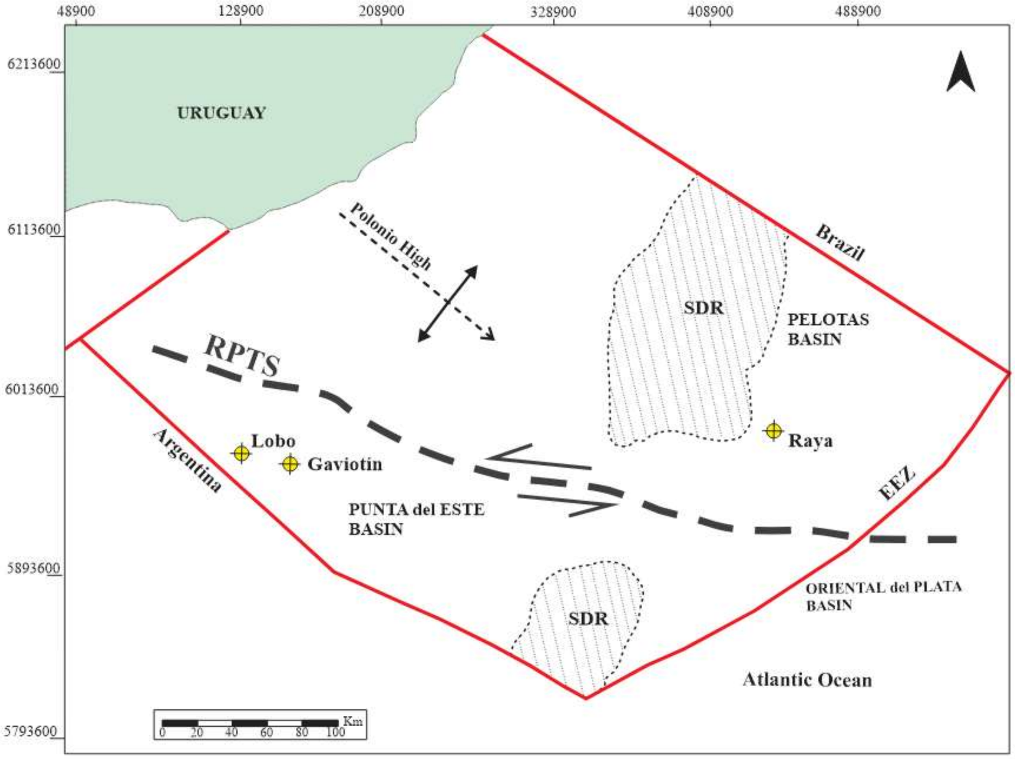

***Figure 1**: UCM basins location Map. RPTS (Rio de la Plata Transfer System)*

Results

A Barremian-Aptian depocenter is identified in the study area, limited by large normal faults, some of which are deep, extending until the Moho. This depocenter develops from west to east, describing a triangular geometry (a bucket shape) that expands into the most distal area. The southern limit of the depocenter corresponds to a set of faults fitting the RPTS, but the northern limit is less well defined and is represented by a set of NNW faults (Fig. 2). Also, the depocenter develops over a transitional crust that exhibits intensive magmatic activity and shows very significant stretching, reaching thicknesses of less than 3 km in some places. The cooling of this magmatic crust would have contributed to the initial subsidence and the creation of the depocenter at the beginning of the first marine transgression (Aptian). Over this magmatic crust is identified a sequence composed of homogeneous set of relatively continuous reflectors with onlap geometries towards the top of the interval, whose upper limit corresponds to a very continuous horizon that surpasses the basement internal highs, interpreted as a transgressive surface. This horizon is correlated with the AR2 horizon, defined by Hinz et al. (1999). Due to the subsidence generated in that sector of the UCM, these are the deepest marine systems developed for the Aptian. In this way, while in the distal area of Punta del Este and Pelotas, the marine Aptian sequence presents constant thicknesses of 800 m that onlaps over the SDRs, in the depocenter region, the marine Aptian reaches a more proximal region, onlapping over the continuation of the Polonio High, and develops thicknesses of up to 1200 m. This depositional control, which is unique to Uruguay's offshore region, involves thicker aptian sequence layers than those recorded in the Orange Basin and potentially higher organic content due to a deposition in a more restricted marine environment.

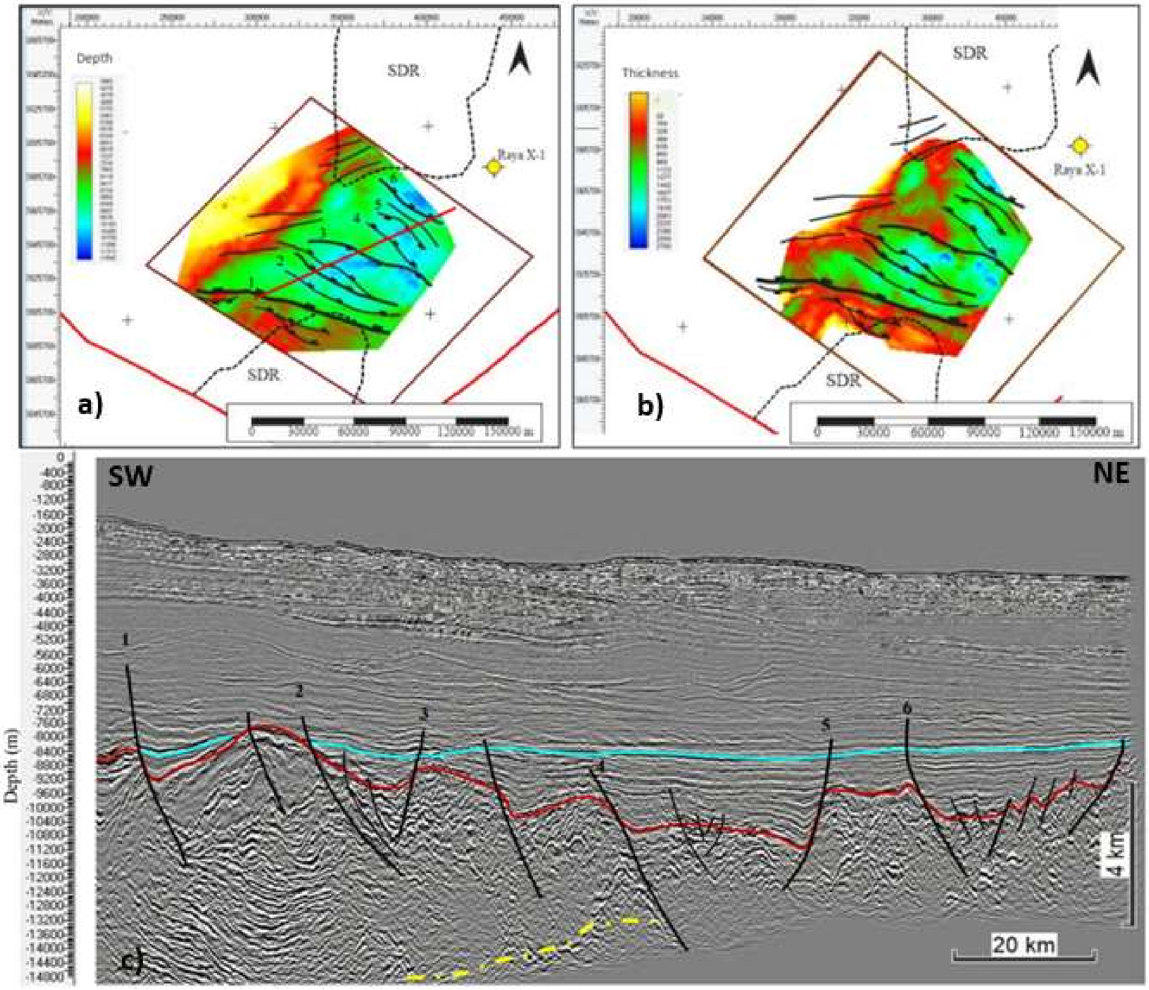

Figure 2: a) Barremian-Aptian sequence structural map in the study area with main faults. Red line: seismic line location showed in c); b) Barremian -Aptian sequence isopach map; c) Seismic section of the study area; red and sky-blue horizon represent base and top of Barremian – Aptian sequence, respectively.

Conclusions

A set of extensive structures, added to the performance of the RPTS (sinestral nature), in an extensive context, would have generated a field of efforts that reactivated WNW-ESE structures inherited from the basement, which facilitated the generation of low areas and the first marine ingression (Aptian) in the UCM. The development of this depocenter favored marine restriction and allowed a larger thickness of source rocks, that had significant consequences for the generation and accumulation of hydrocarbons in the offshore of Uruguay.

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