Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.25238

The Control of Early Cretaceous LIPs on the Rift-Phase Fill of Santos Basin, Brazil

DR. XIAO-FA YANG, PHD

Research Institute of Petroleum Exploration & Development, PetroChina

Large Igneous Provinces (LIPs) significantly impact the tectonic and sedimentary evolution of rift basins. This study examines how LIPs controlled the rift-phase sedimentary fill, particularly the pre-salt lacustrine carbonates in the Santos Basin, a passive margin basin offshore Brazil. During the Early Cretaceous, the basin experienced complex interactions between rift tectonics and magmatic activity, characterized by extensive flood basalt emplacement and volcaniclastic deposits. These processes profoundly influenced the architecture and composition of the rift-phase fill. The emplacement of flood basalts created topographic highs and lows, influencing sediment dispersal patterns and depositional environments. The Santos Basin recorded two important periods of basic magmatic activity in the Early Cretaceous, mainly characterized by the development of continental flood basalts (CFBs). The first stage is Paraná - Etendeka LIP (PE LIP), with an age of approximately 132 ± 1 Ma. It is a product of magmatic activity during the early stage of the rift and controls the paleogeomorphology of the East High (Outer High). The thermal effects of PE LIP led to subsidence of the Santos basin, creating accommodation space for sediment accumulation. The basaltic plateau formed by PE LIP in the basin was favorable for the long-term construction of large-scale carbonate rocks. A lithofacies succession of volcaniclastic/clastic rocks, bioclastic limestones, and microbial carbonates was developed upward. The second stage is Parati LIP, with an age of approximately 115 ± 1 Ma. It is a product of magmatic activity during the sag stage, which led to the uplift of the Central Sag. The Parati basaltic plateau (Central High) was favorable for the development of microbial carbonates in the Santos Basin from the late rift to the sag period. This study underscores the crucial impact of LIPs on the rift-phase sedimentary fill in the Santos Basin. The interaction between magmatic activity and sedimentation affected both the spatial distribution and composition of sedimentary units and influenced the basin's structural evolution and hydrocarbon potential. Understanding LIP dynamics in rift settings is vital for predicting basin architecture and exploring hydrocarbon reservoirs in passive margin basins.